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ABSTRACT

This report includes five documents, three on child care research, and two concerning individual differences and discriminative abilities in newborn and young infants. "The Organization of Infant Day Care Environments: Feedback-Produced Improvements in Staff Job Performance" reports on the effectiveness of monitoring procedures as corrective feedback for four infant care duties. "Open-Environment Design for Infant and Toddler Day Care" studies the environment of day care centers, demonstrating that an open environment facilitates supervision and small group activities. "Menus for Toddler Day Care! Food Preference and Spoon use" describes a measurement system for determining toddler food preference. "American and Uruguayan Infants: Reliabilities, Maternal Drug Histories and Population Differences Using the Brazelton Scale" assesses the behavior of 44 infants from birth to one month using Brazelton's Neonatal Assessment Scale. "Evaluation of Early Development with the Brazelton Scale--Effects of Obstetrical Medication" studies 44 infants analyzing the results in two ways: (1) consistencies, changes, and organization over the first month; (2) relation between behavior patterns of newborns and pain-relief drugs, including general anesthesia, administered to the Mothers during labor and delivery. Tables charted for each observational day show correlations between Brazelton items, state of the infant, patterns of infant behavior, and obstetrical drugs. (JH)

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KANSAS CENTER FOR RESEARCH IN
EARLY CHILDHOOD EDUCATION

ANNUAL REPORT (Part I)

FY '73
November 30, 1973

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Director

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KANSAS CENTER FOR RESEARCH IN EARLY CHILDHOOD EDUCATION

Child Day-Care Research

Todd R. Risley
Principal Investigator

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d. For toddlers:
(a) Determinants of interior design of a toddler center for sleep and small group activities.
(b) Description of the measurement system for determining toddler food preference.

Final Report KCRECE
Child Day-Care Research
Todd R. Risley

Enclosed are three manuscripts which have been submitted for publication. These manuscripts incorporate the following components as specified in our contract:

1. For infants:
   A report on the effectiveness of the monitoring procedures as corrective feedback for at least four child-care duties.

2. For toddlers:
   (a) Determinants of interior design of a toddler center for sleep and small group activities;
   (b) Description of the measurement system for determining toddler food preference.

Open Environment Design for Infant and Toddler Day Care

Sandra Twardosz, Michael F. Cataldo, and Todd R. Risley[1]

ABSTRACT

In designing day-care centers for infants and toddlers, the larger features of the environment were investigated to decide if the centers would be open, or would need walls to separate the activities. A series of studies was done in two infant day-care centers and a toddler day-care center in which routines were alternately carried out in an open or partitioned environment. These studies demonstrated that 1) an open environment facilitates the continuous supervision of children by staff, and of staff by the supervisor, 2) an open enviornment does not adversely affect the sleep of either infants or toddlers, and 3) an open environment is as conducive to small group preacademic activities with toddlers as is a separate room. These studies convinced us that infant and toddler day care can and should be accomplished in an open environment.

The impact of the physical environment on behavior was emphasized by Barker and Wright and their colleagues over twenty years ago (Barker, 1951; Barker and Wright, 1955). Since then many studies have been done relating behavior to the characteristics of the setting in which it occurs. Gump, Schoggen, and Redl (1963) measured the behavior of the same child in different settings, recording everything the child did, dividing the "behavior stream" into episodes, and classifying each episode. Tars and Appleby (1973) employed similar methods to compare the day of a boy at home, and at a residential treatment facility. Ittelson, Proshansky, and Rivlin (1970a) used a behavioral mapping technique to compare private, city, and state mental hospitals on a number of dimensions including distribution of activities on the wards, distribution of activities in bedrooms as a function of bedroom size, and use of bedrooms as a function of bedroom size.

Recently, investigators have realized that aspects of the physical environment can be modified to encourage specific types of behavior. Sommer (1969) measured brief and extended conversation between elderly ladies in a nursing home before and after the seating arrangements in the dayroom were changed. He found that conversation almost doubled when the chairs were moved from their position against the wall to tables on which flowers and magazines were placed. Similarly, Ittelson, Proshansky, and Rivlin (1970b) equipped the seldom-used solarium of a mental hospital with comfortable and attractive furnishings, and found that its percent of the ward's total activity increased, while activity in the corridor and dayroom decreased. Krantz and Risley (1972) experimentally demonstrated that spacing children rather than letting them crowd during teaching demonstrations at a preschool for disadvantaged children was effective in increasing their attention to the teacher. LeLaurin, Cataldo, and Risley (in preparation) also experimentally demonstrated that when a large display board of the infants' feeding schedules was visible from all parts of the day-care center, more infants were fed on time than when the board was not present.

These studies suggest that the arrangement of the physical environment should be one of the first considerations when planning a program of providing care for dependent persons. Staff training can then be accomplished in the context of an environment arranged to facilitate the correct performance of care routines. The following studies were designed to investigate an open environment plan for infant and toddler day care. The open environment was seen as a means of insuring that children would be continuously watched over by the staff so their activities would be supervised and responsive care provided. However, other functions of the centers had to be considered to determine that this environment would not be detrimental to other activities. Therefore, the effect of an open environment on sleep and preacademic activities was also investigated.

The Infant and Toddler Centers

All of the studies were conducted at the Lawrence Day Care Program Infant and Toddler Centers, associated with the Department of Human Development at the University of Kansas and the National Program on Early Childhood Education. The purpose of the program was to develop a technology for caring for a group of up to twenty infants from one month to walking age with five caregivers (Cataldo and Risley, in press), and a group of twenty toddlers from walking to preschool age with four caregivers. Both centers were originally housed in modern two bedroom apartments, which were later structurally modified into open environments.

STUDY I - DETERMINATION OF THE EFFECT OF AN OPEN ENVIRONMENT ON THE SUPERVISION OF CHILDREN

In any situation where a group of very dependent persons is being cared for, it is extremely important for caregivers to be able to watch over them continuously in order to supervise their activities, provide responsive care, and avoid neglect. In an infant center, the staff can be hampered in providing constant care and supervision of all children by an environment which is divided by walls. In such an environment, children must either be left unsupervised, or floor space can only be used when staff members are available to supervise each room. At our Infant Center, a nearly optimal situation exists. Although there are no internal walls, children are rarely left in an activity area unless an adult is present. The exception is the sleep area which can be seen from other parts of the center. This study was done to demonstrate how the supervision of children was affected when the sleep area was separated from the rest of the center by a partition.

Insert photographs 1, 2, 3, and 4 about here

METHOD

Subjects

Twenty-four different children from one month to walking age were attending the Infant Center for full or part-time care, and an average of 13 were present each day. Five staff members cared for the children.

Experimental Conditions

During the first eight days of the study, the Center was an open environment, and the sleep area was not separated from the rest of the Center.

For the next 11 days, a partition was created by hanging a sheet from ceiling to floor, visually separating the sleep area from the rest of the Center. Then, the open condition was in effect for another ten days, the partition condition for six days, and the open condition for ten more days.

Measures

Figure 1 is a scale drawing of the floor plan of the Infant Center. The heavy dashed line between the sleep and play areas represents the partition in use during this study. An observer with a map of the Center entered every hour between 8:30 a.m. and 4:00 p.m. The observer marked an X on the map to indicate the location of each staff member, and noted if the adults were standing or sitting. Then, the observer looked at each area and placed a dot to record the position of each child. The total number of children at the Center was recorded. The observer then went to each of the locations where an X on the map marked the position of an adult, assumed the position the adult had been in, and counted the children each adult could see by turning completely around. At least one-half of the child's body had to be visible to be counted as seen. (It should be emphasized that the observer referred to the dots on the map, representing the position the children had occupied when the observation was taken.) After doing this for each adult, the observer recorded the number of children who could not be seen by any adult. To aid in keeping track of children who could not be seen from the various positions, the dots representing children were crossed off as soon as they were judged to be seen. The percent of children seen was computed by dividing the number of children seen by the total number present.

Insert Fig. 1 about here

If the observer recorded that one or more children could not be seen by any adult, a measurement procedure, instituted on day 27, was used to determine the distance the adult nearest these children would have to travel to see them. A piece of tape was placed on the floor to mark the position of the staff member nearest the unseen children. The observer then walked to a position where these children were visible, and measured the distance from that position to the tape. (All of the children did not have to be visible at once from this final position; only the unseen children had to be brought in view.) Average feet traveled was computed by dividing total feet traveled by the number of observations taken each day.

In order to determine if more than one person could record these data and agree on the results, two observers took the measures simultaneously but independently for 52 checks distributed over 25 days throughout the study. This was accomplished by having both observers enter the Center and record the position of the adults and children simultaneously on separate maps. Then one observer left the room while the other completed the observation procedures. The second observer then re-entered and completed the observation. Several different pairs of observers obtained these independent records throughout the study. Reliability estimates averaged 98% per check for children seen, and 92% for feet traveled. These estimates were computed by dividing the smaller number recorded by an observer by the larger number.

RESULTS

Figure 2 shows the percentage of children seen by any adult, and the number of feet traveled by the nearest staff member to supervise the unseen children. The mean percentage of children supervised in the open conditions was 97%, but only 78% when the partition separated the sleep area. Average feet traveled per observation to supervise the unseen children was only one foot during the open condition, but 6.4 feet during the partition condition.

Insert Fig. 2 about here

STUDY II - DETERMINATION OF THE EFFECT OF AN OPEN ENVIRONMENT ON THE SUPERVISION OF STAFF

Study I demonstrated that a partition separating the sleep area from the open environment reduces the percentage of children who are visible to the staff by as much as 20%. The impaired visibility caused by partitions may also affect the ability of the day-care supervisor to monitor staff activities. A second study was therefore designed to determine if staff supervision is more effective in an open or a partitioned environment.

METHOD

Subjects

Approximately the same number of children were present as during Study I, and were cared for by five staff members, one of whom was the supervisor.

Experimental Conditions

The study lasted 29 days. During the first 8 days, the open condition was in effect, and no internal walls divided the Center. During the next 11 days, sheets were hung from ceiling to floor to separate the sleep, play, diapering, feeding, and receiving and departing areas. The heavy dashed lines on the scale drawing in Figure 1 indicate where the partitions were hung, and the openings for moving from area to area. On the 20th day of the study, the open condition was restored.

Measures

An observer with a map of the Center entered the room every two hours during the day. Times of observation were predetermined for each day so that all half-hours of the day are equally represented in the data. Beginning with the sleep area, the observer quickly moved around the Center clockwise and marked an X to record the location of each staff member, and a circled X to locate the supervisor. If a staff member entered during the observation, that position was recorded last. The observer then stood in the position the supervisor had occupied, as recorded on the map, turned around completely, and recorded the number of staff that could be seen, i.e., visible from the waist up. (It should be noted that the observer judged the number of staff seen by referring to their locations on the map.) Percentage of staff seen by the supervisor was computed by dividing the number seen by the number present.

If the supervisor could not see one or more staff, the distance she would have to travel to see them was measured. The observer moved from the supervisor's location to the various points where she was able to see the staff, and recorded this movement on the map. Two patterns of movement were tried, and the shortest was recorded. For example, if the partitions were up and the supervisor was in the sleep area, she would have to move to several door openings in order to see people in diapering, play,and feeding. Number of feet traveled was computed by measuring the representation of supervisor movement on the map and converting it to feet, and then dividing by the number of observations.

To insure that two people could arrive at similar results using these measures, several pairs of observers took the data simultaneously but independently several times during each condition for a total of 19 checks distributed across 13 days. This was accomplished by having both observers record the staff positions simultaneously on different maps. Then one observer left the Center while the other completed the observation procedures. The second observer then re-entered and completed the procedure. Reliability estimates averaged 85% per check for percentage of staff seen by the supervisor, and 80% for number of feet traveled to see remaining staff. These were computed as in Study I.

Probe observations were taken several times during the partitioned and final open condition to determine the percentage of children that could be seen by the supervisor and the number of feet traveled to see the remaining children. (The same methods were used as during Study I.)

RESULTS

Figure 3 shows the percentage of staff seen by the supervisor and the number of feet traveled per observation to monitor the remaining staff. The average percentage of staff seen during the open conditions was 76%, but only 44% could be seen when the Center was partitioned. Similarly, the supervisor had to travel only 2.8 feet per observation to supervise unseen staff during the open conditions, as opposed to 12.3 feet during the partitioned condition.

Insert Fig. 3 about here

Probe observations indicated that during the partitioned condition the supervisor could see only 30% of the children from her location, and traveled an average of 36 feet to see the remaining children. During the open condition, however, 66% of the children could be seen, and the supervisor had to travel only 16 feet to see the others.

STUDY III - DETERMINATION OF THE EFFECT OF AN OPEN ENVIRONMENT ON SLEEP AT THE INFANT CENTER

Studies I and II showed that an open environment plan provides a solution to the problem of supervising children and monitoring staff in an infant day care center. However, with an open environment the sleep area would not be separated by a wall from the rest of the center. This might adversely affect the children's sleep because of the light, noise, and sight of other activities. If the children could not sleep under these conditions, the advantages of the open center would be outweighed by the disadvantages. The following studies were designed to determine if the open environment would adversely affect the children's sleep. The first study was done at a pilot Infant Center where the sleep area was separated by a wall, and the second study was done in the structurally modified open Center.

PART A - PILOT INFANT CENTER

METHOD

Subjects, Setting, and Nap Routine

The pilot Infant Center was an unmodified two-bedroom apartment with permanent walls.

Thirteen children ranging from one month to 12 months of age, who attended the Infant Center for full or part-time care, participated in the study. The cribs were arranged in one of the bedrooms of the apartment, and the children were put down for naps each day, either at the times specified by their parents, or when the supervisor decided they were ready for a nap. Most of the babies did not require any additional attention before going to sleep; however, staff occasionally soothed a restless baby by patting or rubbing his back. Center policy specified that the child be removed from the crib as soon as he had awakened.

Experimental Conditions

Alternate conditions of noise and light and quiet and dark were created in the sleep room. During noise and light conditions an open environment was simulated as much as possible. The door was left open so the noise from other activities could be heard, and some of these activities were visible from some of the cribs. Light entered the area from a large picture window covered only by a thin white drape. These conditions were in effect for the first 19 days of the study. During the quiet and dark condition, in effect for the next 14 days, the door to the sleep area was closed, and the picture window was covered with aluminum foil to make the room very dark. The noise and light condition was then repeated for another 12 days.

Measures

Throughout the study an observer quietly entered the sleep room every ten minutes for the four hours each day (10:00 a.m. - noon, 1:30 - 3:30 p.m.) when the greatest number of children were scheduled to take naps. The observer glanced at each child for an instant and recorded if he was sleeping, awake, or crying, and if an adult was present in the sleep room. Percentage of sleep, crying, and presence of an adult were computed by dividing the number of observations of these behaviors by the total number of observations. In addition, the Infant Center staff recorded the time each child was put down for a nap and the time he was removed from the sleep room. From other observations which were being taken at the Infant Center every 15 minutes, data on the percentage of children asleep by the first quarter-hour check after being put in the crib were obtained. This was computed by dividing the number of children whose first entry indicated sleep by the number of naps taken that day.

Two observers recorded the behaviors simultaneously but independently several times during each condition for a total of 117 checks distributed across 13 days. Several pairs of observers collected these independent records during the study. Reliability estimates were computed by comparing both observers' records for each observation. An agreement was scored if both had recorded the same behavior. Percentage agreement was obtained by dividing the number of agreements by the sum of agreements and disagreements. Reliability estimates were 95% per check for sleep, 80% for crying, 88% for presence of an adult, and 97% for time in and out of crib.

RESULTS

Figure 4, showing the percentage of sleep and crying that occurred during each condition, clearly indicates that room conditions make no difference. Mean percentage of sleep was 55% and 60% for the noise and light conditions, and 63% for the quiet and dark condition. Mean percentage of crying was 7.5% and 7% for the noise and light conditions, and 8.4% for the quiet and dark condition. The results apply not only to the group, but also to individual children; i.e., none of the babies' sleep was adversely affected by noise and light.

Insert Fig. 4 about here

Staff members spent about the same amount of time in the sleep room (about 8%) throughout the study. The children spent about the same amount of time in their cribs and were put down for naps at about the same time throughout the study.

PART B - STRUCTURALLY RENOVATED OPEN INFANT CENTER WITHOUT WALLS

METHOD

Subjects, Setting, and Nap Routines

Later, when the walls were removed and the Infant Center became an open environment as depicted in the floor plan (Figure 1), a second study was done. Twenty-four different children from one month to twelve months of age participated in the study, although the daily average was 13. Nap routines were the same as during the previous study.

Experimental Conditions

The sleep area was alternated between open and partition conditions. During days 1-5 and 16-21, the sleep area was separated from the rest of the Center by a sheet hung from ceiling to floor. During days 6-15 and 22-35, the sleep area was open to the rest of the center. Although light and noise remained at about the same level during both conditions, none of the Center's activities were visible to the children in the sleep area during the partition conditions.

Measures

Throughout the study, an observer entered the sleep area every hour from 8:30 a.m. to 4:00 p.m. On alternate days, these checks were taken on the hour or half-hour. Number of children in the area, number sleeping, number crying, and presence of an adult were recorded. These behaviors were computed as during the previous study. Two observers recorded the behaviors simultaneously but independently throughout the study for a total of 41 checks distributed across 19 days. Several pairs of observers took these independent records. Reliability estimates per check averaged 98% for sleep, 100% for crying, and 100% for presence of an adult. These were computed as during the previous study.

RESULTS

Figure 5 shows the percentage of sleep and crying during both experimental conditions. The mean percentage of sleep was 73% and 65% during the partition conditions, and 75% and 62% during the open conditions. Mean percentage crying was 7.4% and 7.3% during partition conditions, and 2.4% and 3% during open conditions. Thus, sleep was not affected, and crying, which was very low throughout the study, occurred even less during the open conditions. Amount of adult time in the sleep area remained constant throughout the study at about 26%.

Insert Fig. 5 about here

STUDY IV - DETERMINATION OF THE EFFECT OF AN OPEN ENVIRONMENT ON SLEEP AT THE TODDLER CENTER

Studies I, II, and III showed that an open environment not only provides a solution to supervising children and monitoring staff, but also does not adversely affect the sleep of young infants. However, the question remains if an open environment, which is ideal for the supervision of older children as well, would be conducive to the sleep of "toddlers", who are beginning to walk and talk. These older children are more likely to resist naptime than are infants. Furthermore, in our Center they do not use cribs, but sleep on small foam mattresses on the floor so that they can easily get up and run around. For this age group, it might be necessary to provide a separate room for sleep, free from the distractions of other activities. The following study was designed to determine if an open environment would adversely affect toddlers' sleep. It was performed at the pilot Toddler Center, an unmodified two-bedroom apartment.

Insert photograph 5 (toddlers
sleeping in open play area) about here

METHOD

Subjects and Nap Routine

Thirteen children, ranging in age from 13-30 months, who attended the Toddler Center for full or part-time care, participated in the study. A mean of nine children was present each day for naps. Each child had a foam mat fitted with a contour sheet and was provided with a light blanket. The mats were arranged in the nap area, and children entered the area individually after finishing lunch. A staff member remained in the area throughout naptime to assist the children in lying down on their mats, and to calm the restless ones by rubbing their backs or foreheads. As the children awakened, they left the nap area individually and were taken to the bathroom and then to the play area. If a child did not fall asleep, he remained in the nap area until a staff member had returned from lunch to supervise an activity.

Experimental Conditions

The nap area was arranged in three different ways during the study. During the dark closed room conditions, the nap area was a separate room which was made very dark by covering the window with aluminum foil. The door was closed to minimize noise from other parts of the Center. During the light open room condition, the window was covered only by a white drape, and the door was left open so the children could hear the sounds of the lunch, bathroom, and clean-up routine and other children playing in the play area. During the open play area condition, the nap area was transferred to the play area where the children were not only exposed to light and noise, but were in the same area as the part-time children who were playing before going home. In the play area, the children could also see the staff cleaning up after lunch. Furthermore, children who awakened first began playing in the same area. The sequence of conditions was: dark closed room, light open room, dark closed room, open play area, dark closed room, open play area. The study lasted 78 days.

Measures

The staff member in charge of the nap area observed each child in that area every 15 minutes throughout naptime. (These sleep checks were routinely used to inform the parents about their children's naps.) The staff member glanced at each child for an instant, and recorded if he was sleeping, awake, or crying. Average minutes asleep was computed by dividing the total number of observations the children were recorded as sleeping by the number of children taking naps, and multiplying by 15. Percentage of children sleeping across successive 15-minute observations was computed by dividing the number sleeping at a particular check by the number of children taking naps that day, for the last five days of each of the dark closed room, and open play area conditions. In addition, an observer quietly entered the nap area every four minutes for one hour or until all children were asleep, looked at the adult in charge for an instant, and recorded if the adult was attending to a child (touching, talking to, covering, etc.). The percentage of time an adult spent attending to children was computed by dividing the number of observations this occurred by the total number of observations.

To insure that more than one person could agree on the behaviors, several observers took the sleep checks with the staff several times during each condition for a total of 148 checks distributed across 22 days. A second observer also observed on staff behavior. To make sure the staff took the sleep checks on time, an observer entered the Center at unspecified times and ascertained if the previous checks had been taken. Reliability per check averaged 99% for sleep and 98% for adult attention, and was computed as during the previous study.

RESULTS

Figure 6 shows the average minutes asleep for the group of toddlers during all conditions of the study. The mean for the dark closed room was 107 minutes, for the light open room 101 minutes, and for the open play area 102 minutes. It can be seen that, although the overall amount of sleep was not affected by the environmental conditions, there was a great deal of day-to-day variability.

Insert Fig. 6 about here

Figure 7 shows the average minutes asleep in the closed dark room and open play area for the ten children who slept under both conditions. Some slept a little longer in the closed dark room while others slept a few minutes longer in the open play area. Again, the children slept as well in the open play area as in the dark closed room, and some children took much longer naps than others in either condition.

Insert Fig. 7 about here

Figure 8 shows the percentage of children sleeping across successive fifteen-minute observations in the dark closed room and the open play area. The figure indicates that the children fell asleep faster in the dark closed room than they did in the open play area. By 12:45, 90% of the children in the dark closed room were asleep, but only 62% in the open play area were asleep. However, the children also awakened earlier and more gradually in the dark closed room. In the dark closed room, the children tended to awaken in 10-15% increments from check to check, whereas between 2:00 and 2:15 and 2:15 and 2:30 the percent awake in the open play area increased by 35% and 22%.

Insert Fig. 8 about here

Thus, the children slept about as long in the open play area as in the dark closed room, but took slightly longer to fall asleep and awakened more as a group. The adult spent the same amount of time attending to the children throughout the study, about 66% of the time children were awake. Crying occurred so rarely that it was not included as a dependent variable.

STUDY V - DETERMINATION OF THE EFFECT OF AN OPEN ENVIRONMENT ON TODDLER PREACADEMIC ACTIVITIES

Studies I and II showed that an open environment plan provides a solution to the problem of supervising children and monitoring staff in an infant day-care center. Studies III and IV showed that an open environment is not detrimental to the sleep of either infants or toddlers. The final study investigates the question of whether an open environment is conducive to carrying on preacademic small group activities for toddlers. In these activities, children were expected to sit at a small table for ten minutes with an adult and another child and participate in a semi-structured way with preacademic materials. Such activities, because they focus a child's attention on one activity for a period of time, can be used to teach children the proper use of play materials. Small group activities also have been shown to be a means of providing children with short periods of concentrated personal attention from adults, which they may not receive in a group (Twardosz, Cataldo, and Risley, (in preparation).

Although an open environment does not adversely affect toddlers' sleep and provides for continuous supervision of their activities, a separate room may be needed for preacademic activities. The sights and sounds of the other children in the play area might be distracting for those at the preacademic activity, or they may leave the table to join the larger group. In addition, children from the play area may disrupt the preacademic activities by grabbing the materials or trying to participate, or the adults might attend less to the children if another adult were available to talk to.

Insert photograph 6 about here
(toddlers at preacademic activities)

METHOD

Subjects and Description of Preacademic Activities

Sixteen full or part-time children at the Toddler Center, ranging in age from 13-26 months, participated in the study. All four staff members conducted the activities.

Six activities were planned and tested with the toddlers before the study began. These were puzzles, beads, coloring, body parts, pegs, and pictures. The staff received brief instructions for each activity, describing what they should try to have the child do. For example, the instructions for puzzles were to give the child one piece at a time, to help him put it in, let him try by himself next time, etc. For all activities, children and adults sat at a child-sized table.

Three ten-minute sessions, each involving two children and an adult, were held both in the morning and the afternoon. The observer selected children for a preacademic activity by drawing names from a name pool of all children present. Names were not replaced until all the children had participated in an activity. Staff were chosen to conduct the activities so that each one conducted about the same number of activities in each of the environmental conditions, and each conducted a variety of the six activities.

Experimental Conditions

At the beginning of the study, preacademic activities were held either in a separate room or behind a screen in the play area. Environmental conditions were counterbalanced across time of day such that on day 1 morning activities were held in a separate room and afternoon activities were held behind the screen. The following day the order of conditions was reversed. This rotation continued for twelve days.

For the next sixteen days, preacademic activities were held either behind the screen or in the open play area. The conditions were counterbalanced across the time of day as described above. Throughout the entire 26 days of the study, type of activity was counterbalanced across time of day and type of environment.

For the final four days of the study, the adults were given specific instructions not to try to keep the children in their chairs by either verbal or physical means. If a child left the activity, the adult was to continue interacting with the remaining child, and resume interaction as soon as the child returned to the activity.

Measures

The behavior of both the children and adults was measured, including child attention to activity, out of seat, number of products (i.e., pieces placed in puzzle, beads on string, etc.), and adult attention to children. Each child at the preacademic activity was observed for an instant four times per session and recorded as attending if he was manipulating the play materials or looking at the play materials, the adult, or the other child at the activity. If the child was completely out of seat, then this was recorded.

Each child was also observed for one minute four times per session. The observer counted the number of times the child accomplished the product for that activity with or without adult help. These were defined as follows for each activity:

Puzzles- number of times a piece was placed in its correct space

Beads- number of times the string was put through the hole of a bead

Pegs- number of times a peg was put in its hole and remained standing after the child removed his hand

Pictures- number of times child pointed correctly to something in the picture after an adult request

Body Parts- number of times child pointed correctly to a body part or imitated the adult after an adult request

Coloring- after the session the observer scored the child's drawing from 1 to 4. A rating of 1 meant less than one-fourth of the page was colored, while 4 meant almost all was colored.

The adult was observed for a 5-second interval four times per session and recorded as attending to a child if she touched him, talked to him, or used a play material with him, i.e., touched the same material, handed it to the child or took it away, or demonstrated how to use it. In addition, during the final nine days of the study, when sessions were conducted in the open play area, the observer watched the play area for 5 seconds every 5 minutes and recorded whether or not other children were within three feet of the activity table and whether they were disrupting the activity by taking materials, talking to the child at the table, etc. Data were computed as follows: number of products was the average total for all the children who particiapted in a set of morning or afternoon activities; % child attention, % out of seat, and % intervals adult attention were the number of observations the behavior occurred divided by the total number of observations.

In order to determine that two people could agree on the occurrence of the behaviors, two observers recorded them simultaneously but independently at least one session per day throughout the study for a total of 52 checks distributed across 30 days. Several pairs of observers took these independent records. Reliability estimates per check, computed as during the previous study, were 94% for child attention, 90% for out of seat, and 98% for adult attention. For products, each one minute observation was compared, and the smaller number recorded by an observer was divided by the larger. The reliability estimate was 89%. Both observers agreed that no disruptions had occurred, and when a child had been within three feet of the activity.

RESULTS

Figure 9 shows the number of products, percentage of time children attended to the activity, percentage of 5 second intervals the adult attended to a child, and the percentage of time the children were out of their seats. None of these measures indicated that one environment was superior as a setting for preacademic activities, although when screen and open play area were compared, slight differences were obtained in favor of the screen. In all conditions, both children and adults participated almost all of the time. Furthermore, the data on the behavior of the rest of the children in the play area indicated that, although at least one child was usually within three feet of the activity (71% of the observations), no disruption was ever observed.

Insert Fig. 9 about here

DISCUSSION

This series of studies comparing day-care routines in open and partitioned environments clearly shows the open environment to be desirable. In the open environment, the staff were better able to continuously watch over the children, and the supervisor could more easily monitor the staff. Furthermore, infant and toddler sleep were not adversely affected by an open environment, and preacademic activities for toddlers could be carried out as successfully in an open environment as in a separate room. Thus, it can be concluded that infant and toddler day care can and should be accomplished in an open environment.

Although the open environment did not appear to be detrimental to sleep or preacademic activities, alternative explanations for these results were recognized. Particular attention was given to staff behavior, since changes in this variable could have countered environmental effects. Staff could have attended to the children differentially, or put them in their cribs later in one condition than in another. Staff behavior was measured to be certain this had not occurred. Similarly, staff behavior was constrained in the study on preacademic activities, to make sure they did not keep the children in their seats or keep other children from disrupting the activities through their increased efforts.

Another dimension of concern was crying, since environmental conditions which produced a great deal of crying would probably not be recommended regardless of the other benefits obtained. At the Infant Center, it was found that the level of crying either remained the same or was slightly lower in the open environment. At the Toddler Center, crying occurred so infrequently that it could not be used as a dependent variable.

The reactions of staff to the open and partitioned environments were obtained by means of a short questionnaire distributed during Study II when each of the areas of the Infant Center was separated from the others. The staff members were asked what type of environment they preferred to work in, and what type they felt the babies preferred. Eighty percent responded they would rather work in an open environment. Reasons given revolved around the fact that they could see other areas of the center, which made caring for the babies easier.

However, eighty percent also felt that the sleep area should not be part of the open environment, but should be located in a separate room. The staff strongly believed that the open environment was hindering the babies' sleep, whereas these studies showed no difference in onset or duration of sleep between the open and closed environment. Clearly, the staff had a preconceived idea about the benefits of sleeping in a separate room, which was not borne out by the facts.

Other preconceived ideas, which may have as little basis in fact as this one, may be preventing the adoption of the open environment design in other situations where dependent persons are cared for, i.e., in classrooms, residential treatment facilities, etc. The feeling that the open environment leads to distractions from desired behaviors was not supported by the present studies, for children were found to sleep just as well and to participate fully in preacademic activities despite the presumed distractions around them.

These studies, therefore, suggest that at least some of the disadvantages of the open environment have been highly overrated. Further study to determine the desirability of the open environment design in other situations can help to make its benefits available to greater numbers of people.

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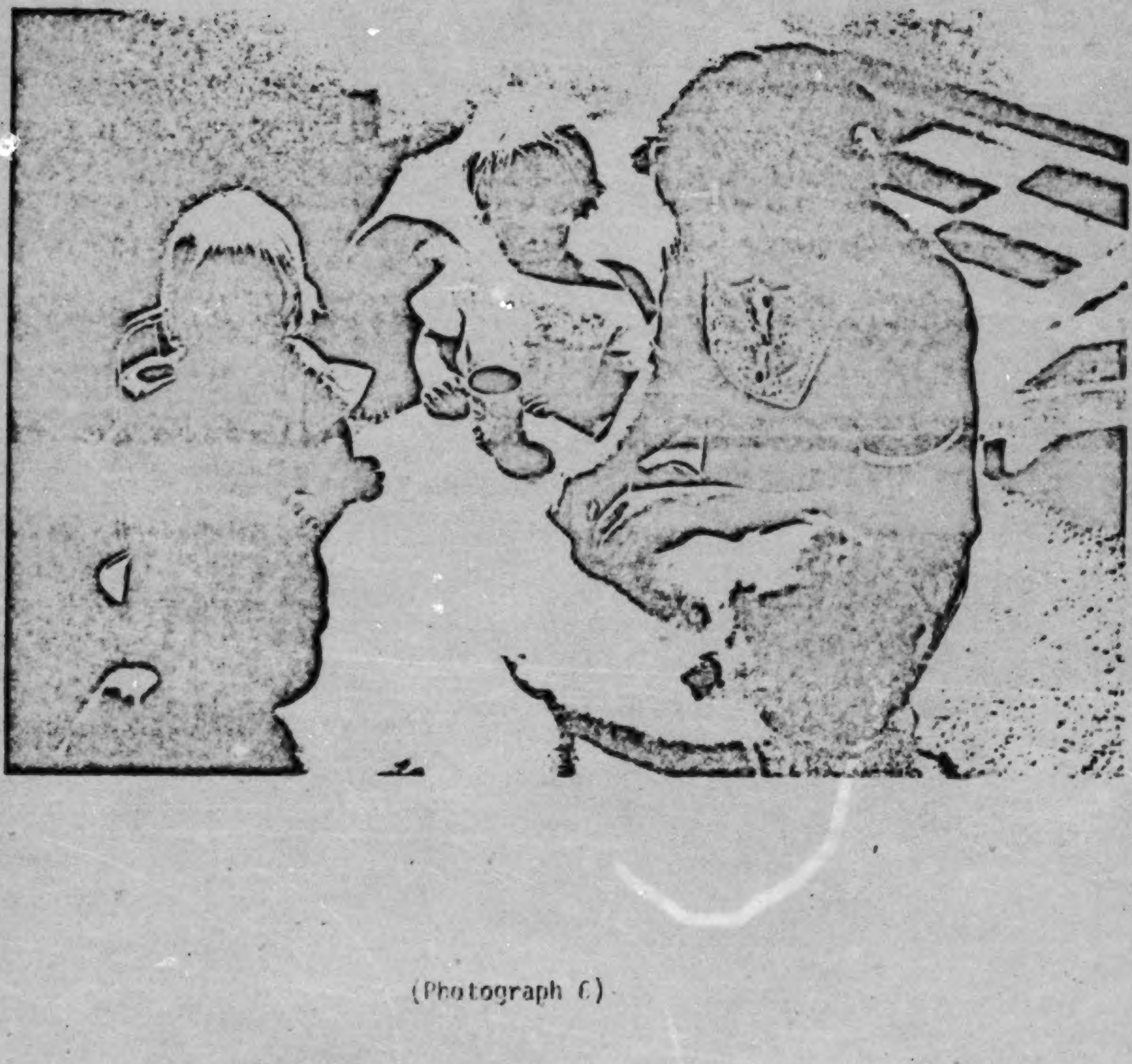
FOOTNOTE

1. This is one of a series of projects conducted by the Living Environments Group at the University of Kansas under the direction of Todd R. Risley. The authors wish to particularly thank Martha Bedlington, Carol Siegele, and Nancy Krompotich, for their assistance during the study. This program is supported in part by grants from the U. S. Office of Education to the National Program on Early Childhood Education and to the University of Kansas' Kansas Center for Research on Early Childhood Education. The first author was partially supported by a fellowship from the Graduate School at the University of Kansas, and the preparation of the manuscript was partially supported by the Johnny Cake Child Study Center. Reprints can be obtained from Dr. Todd R. Risley, Johnny Cake Child Study Center, Mansfield, Arkansas 72944.

PHOTOGRAPHS CAPTION

Four views of the open environment Infant Center showing the ease of supervision when there are no walls. Top left, view of the play, sleep, and diapering areas from the feeding area. Top right, view of the receiving and diapering areas from the food preparation area. Bottom left, view of the play, feeding, food preparation, and receiving areas from the sleep area. Bottom right, view of the feeding and food preparation areas from the play area.

(Photograph 5)



(Photograph C)

FIGURE CAPTIONS

Fig. 1. Scale drawing of the Infant Center. The center is divided into areas according to function. Low, movable baby barriers (dotted lines) which separate the areas allow the staff, but not the babies, to move easily from area to area. Dashed lines represent the partitions in use during Study I (partition between sleep and play areas only) and Study II (all partitions).

Fig. 2. Percentage of children at the Infant Center visible to one or more staff, and the number of feet the staff member nearest the unseen children was required to travel to see them, when the sleep area was part of the open environment, and when a partition separated the sleep area from the rest of the Center.

Fig. 3. Percentage of staff at the Infant Center visible to the supervisor from her position and the number of feet she traveled to monitor any unseen staff during open conditions, when no partition separated areas of the Center, and during partitioned conditions, when each area of the Center was separated by a partition.

Fig. 4. Percentage of crib time babies spent sleeping and crying in the sleep room of the pilot Infant Center during conditions of noise and light, when the door was left open and the room was light, and quiet and dark, when the door was closed and the room was very dark. Heavy solid lines indicate means for each condition.

Fig. 5. Percentage of crib time the babies spent sleeping and crying during conditions when the sleep area of the renovated, open environment Infant Center was not separated from the rest of the Center (open conditions), and when the sleep area was separated by a partition from the rest of the Center.

Fig. 6. Average minutes asleep for a group of children at the Toddler Center sleeping in a dark closed room, a light open room, and the open play area. The open play area was not only light and noisy, but children were playing in the area.

Fig. 7. Average minutes asleep for ten children at the Toddler Center sleeping in a dark closed room and the open play area.

Fig. 8. Percentage of children asleep at the Toddler Center across successive fifteen-minute observations when they slept in a dark closed room and the open play area.

Fig. 9. Number of products, percentage of time children attended to activity, percentage of 5-second intervals adult attended to child, and percentage of time children were out of seat at the Toddler Center when preacademic activities were conducted in a separate room, in the play area behind a screen, and in the open play area.

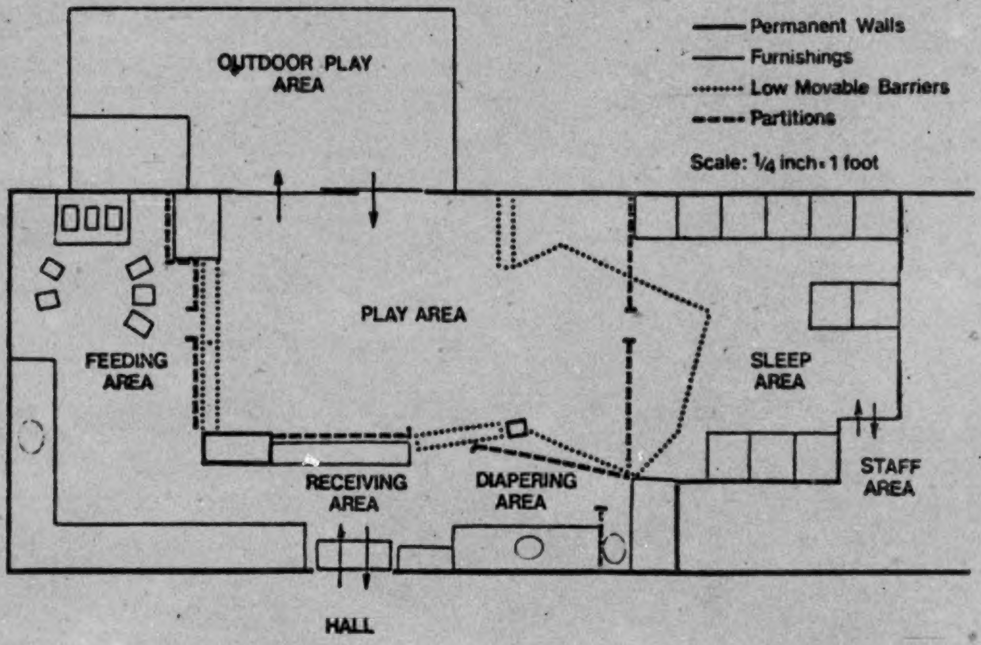

OUTDOOR PLAY AREA
Permanent Walls
Furnishings
Low Movable Barriers
Partitions
Scale: 1/4 inch = 1 foot
PLAY AREA
FEEDING AREA
SLEEP AREA
RECEIVING AREA
DIAPERING AREA
STAFF AREA
HALL

Fig. 1

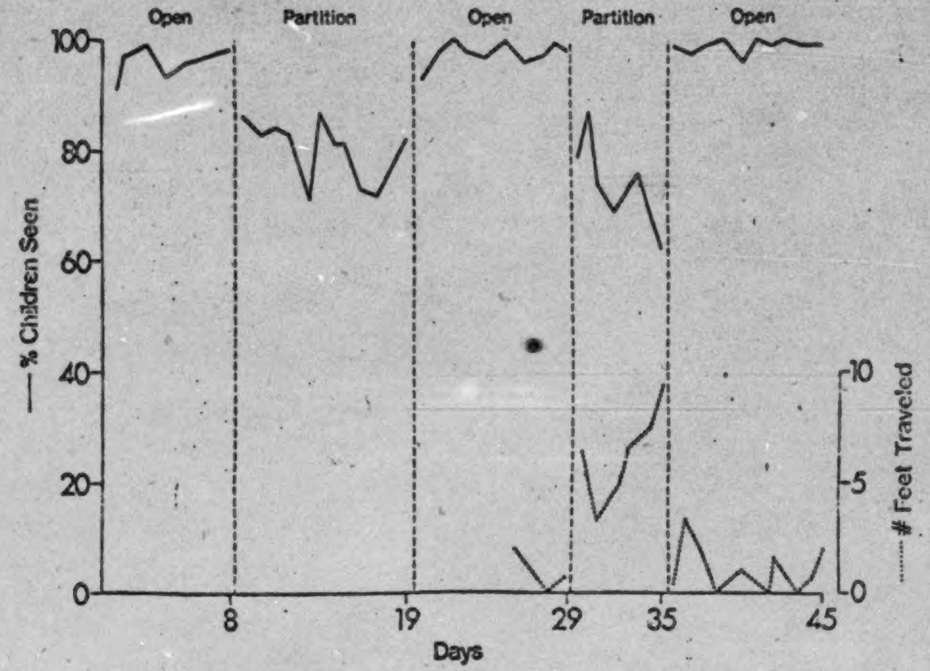
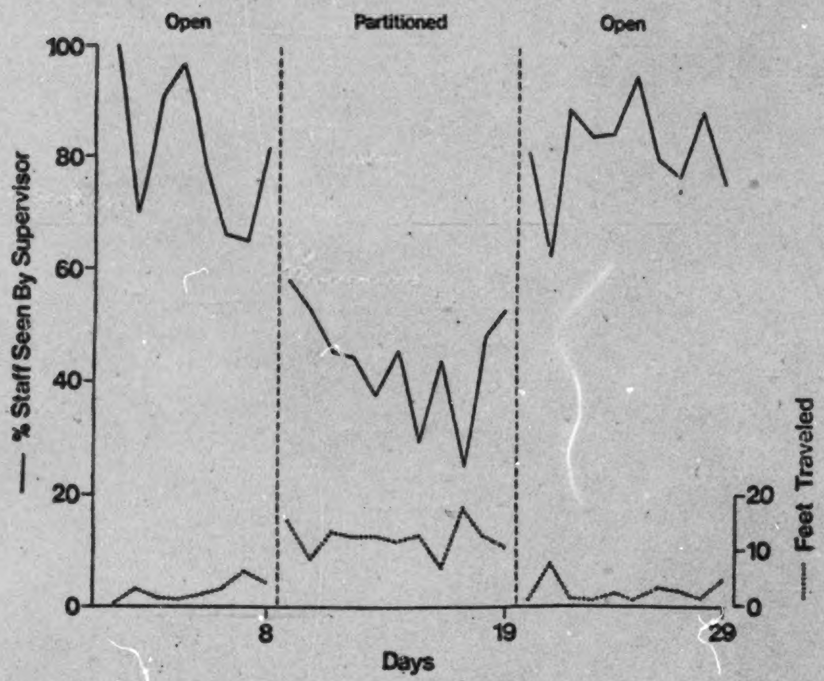

Open
Partition
Open
Partition
Open
100
80
60
40
20
0
— % Children Seen
10
5
0
# Feet Traveled
8
19
29
35
45
Days

Fig. 2



Open
Partitioned
Open
— % Staff Seen By Supervisor
100
80
60
40
20
0
8
19
29
Days
20
10
0
---- Feet Traveled

Fig. 3

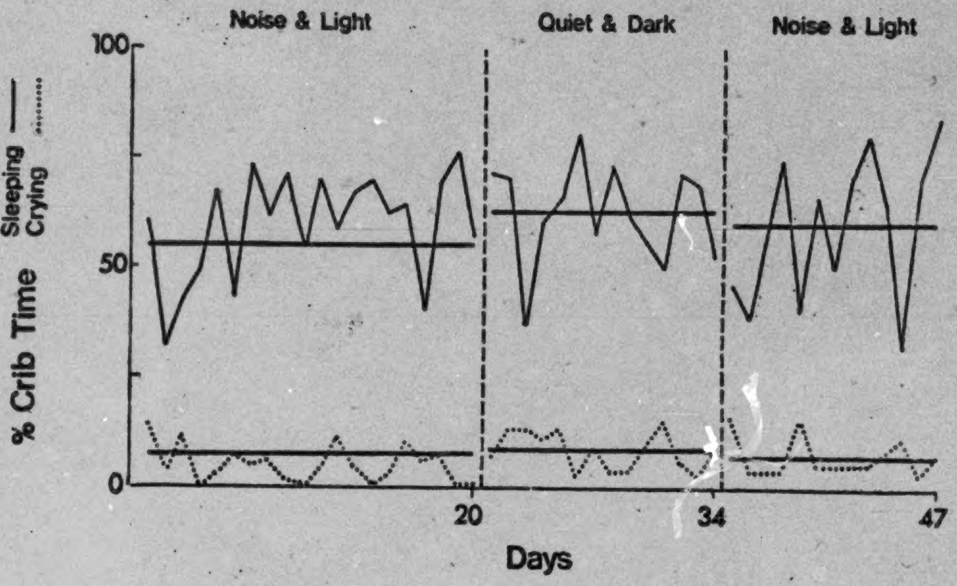

Noise & Light
Quiet & Dark
Noise & Light
100
50
0
% Crib Time
Sleeping
Crying
20
34
47
Days

Fig. 4

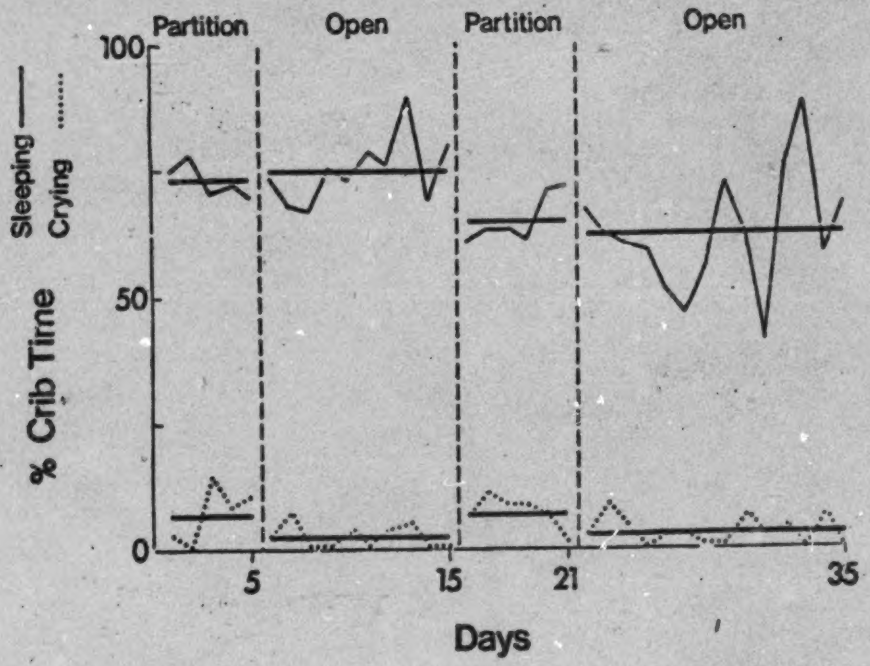

Partition
Open
Partition
Open
Sleeping ——
Crying ……
% Crib Time
100
50
0
5
15
21
35
Days

Fig. 5

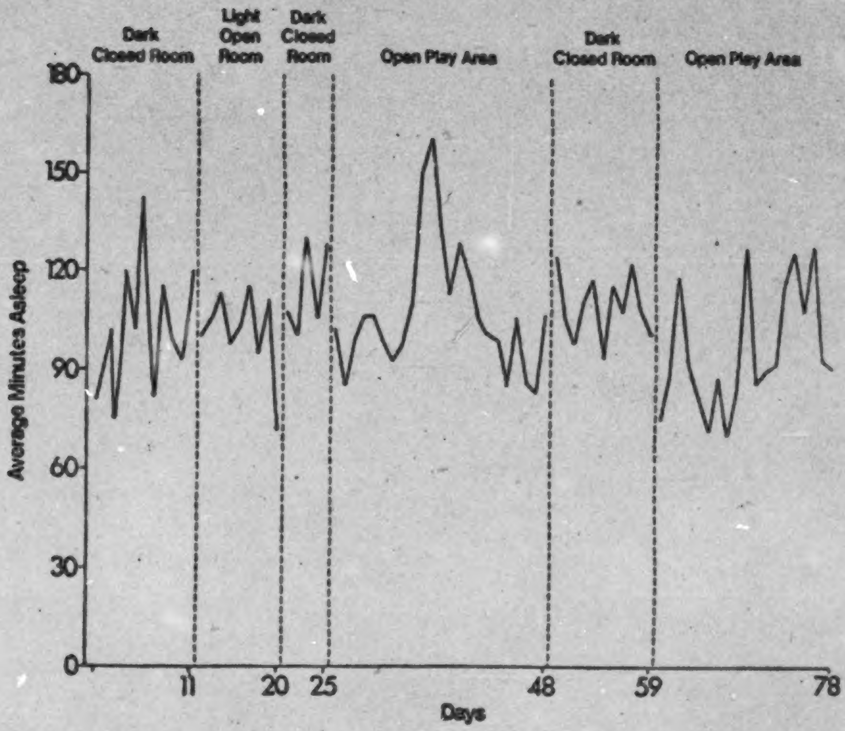

Dark Closed Room
Light Open Room
Dark Closed Room
Open Play Area
Dark Closed Room
Open Play Area
Average Minutes Asleep
180
150
120
90
60
30
0
11
20
25
48
59
78
Days

Fig. 6

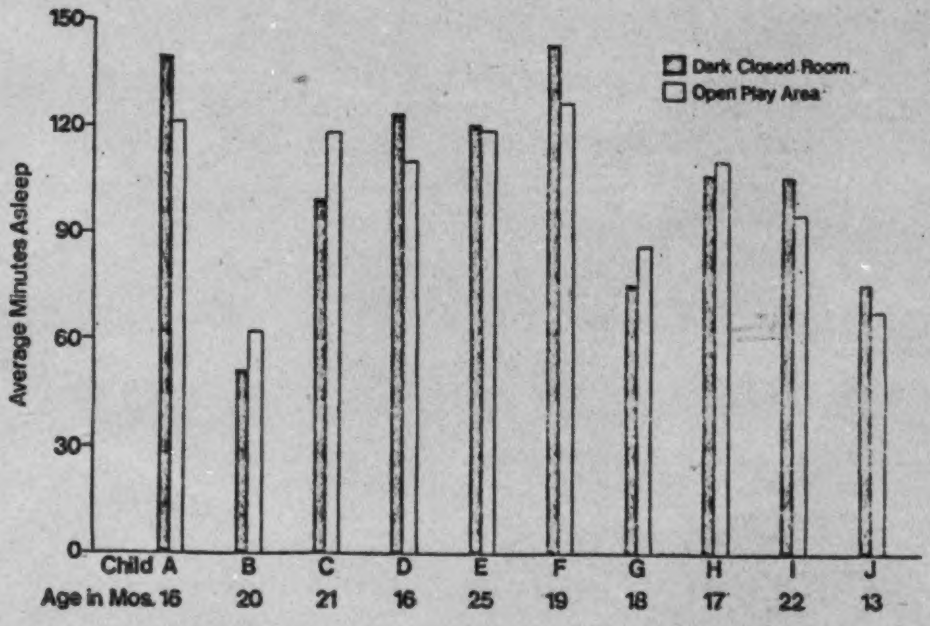

150
120
90
60
30
0
Average Minutes Asleep
▨ Dark Closed Room
☐ Open Play Area
Child A B C D E F G H I J
Age in Mos. 16 20 21 16 25 19 18 17 22 13

Fig. 7

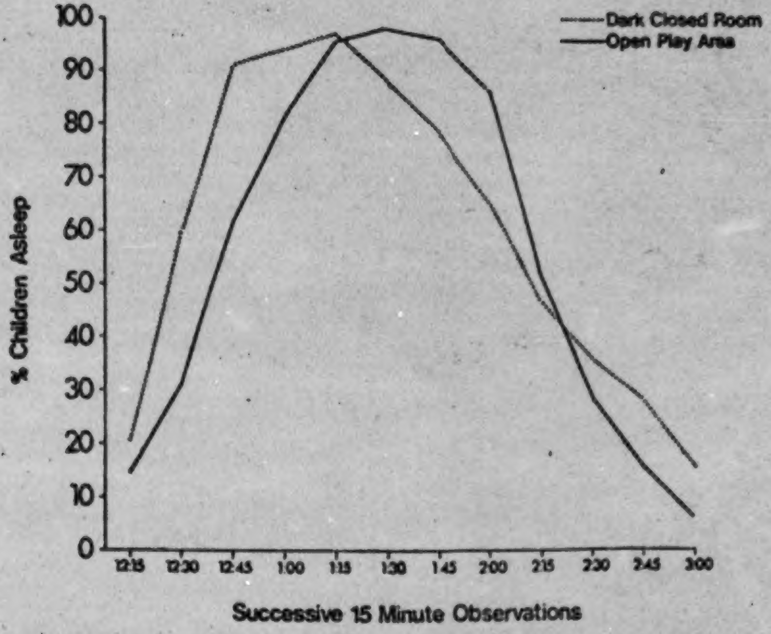
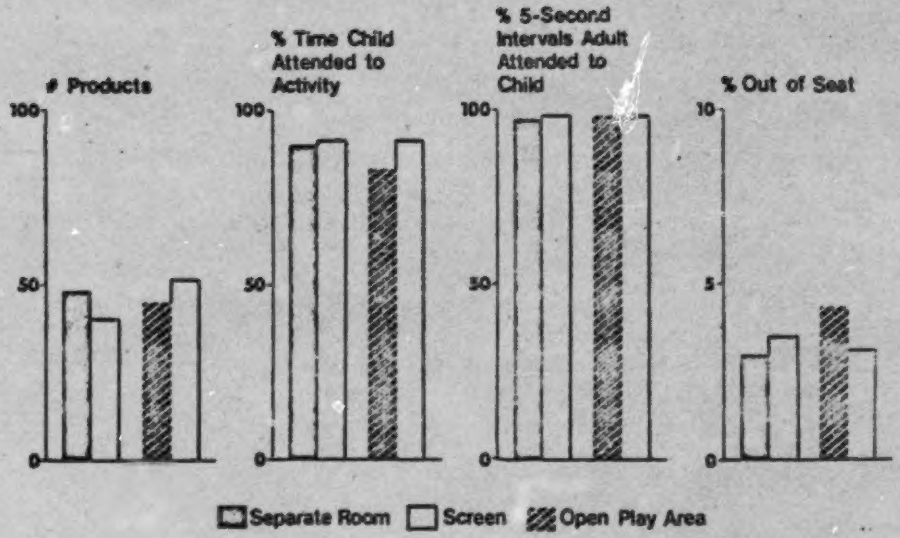

Dark Closed Room
Open Play Area
100
90
80
70
60
50
40
30
20
10
0
% Children Asleep
12:15
12:30
12:45
1:00
1:15
1:30
1:45
2:00
2:15
2:30
2:45
3:00
Successive 15 Minute Observations

Fig. 8



# Products
100
50
0
% Time Child Attended to Activity
100
50
0
% 5-Second Intervals Adult Attended to Child
100
50
0
% Out of Seat
10
5
0
Separate Room
Screen
Open Play Area

Fig. 9

THE ORGANIZATION OF INFANT DAY CARE ENVIRONMENTS:
FEEDBACK-PRODUCED IMPROVEMENTS IN STAFF JOB PERFORMANCE

Kathryn LeLaurin[2] and Todd R. Risley

University of Kansas

Knowledge of results or feedback on performance have long been considered important to learning and behavioral change (Trowbridge and Cason, 1932; Pryer and Bass, 1950). Some studies have examined the effects of different types of feedback, such as knowledge only of correct responses, or only incorrect, or both (Buss and Buss, 1956; Hutchinson and Lair, 1971; Schroth, 1970), while others have investigated the combination effects of feedback and some type of reinforcement on phobic (Leitenberg, Agras, Thompson, and Wright, 1968), academic (Kirby and Shields, 1972; Salzberg, Wheeler, Devar, and Hopkins, 1971), and postural, face-touching, and voice-level behaviors (Schwarz and Hawkins, 1970). Azrin, Rubin, O'Brian, Ayllon, and Roll (1968) used a noise apparatus to provide feedback on slouching behavior and thereby eliminated it, the feedback functioning as a punisher. A later study (O'Brian and Azrin, 1970) demonstrated the information properties of tactile stimulatory feedback to both increase and decrease slouching. Bernal (1969) and Herbert and Baer (1972) used feedback to improve parent-child interactions, while Cooper, Thomson, and Baer (1970) demonstrated that it was functional for improving target behaviors in preschool teacher trainees.

While the exact role of feedback, be it informational, motivational, or reinforcing, is a subject for further experimental analysis, it is clear that feedback is functional in changing behavior, and might be used as an effective tool for behavioral change in still other settings. Employers, for instance, are constantly on the lookout for means to improve or at least control employee performance, since one key to the efficient functioning of any work setting is that all staff conform to prescribed regulations regarding their jobs.

Several studies (Panyon, Boozer, and Morris, 1970; Pierce and Risley, in press) have indicated that mere specifications of these regulations, or admonitions for failure to comply with them are often insufficient to insure quality performance, and that feedback and additional contingencies were necessary to produce desired improvements.

The safety and well-being of children in group care settings is an important planning consideration, and is probably highly dependent upon competent staff. For these reasons, methods of monitoring and controlling job performance in the Infant Day Care Center are of priority importance, and, as in any work setting, this task naturally falls upon the Supervisor. Since at the Center this individual has many other responsibilities, an ideal method would be one requiring minimal time and effort on her part, but would result in high quality performance.

The Supervisor and experimenter frequently discussed areas of concern in the Infant Center, especially those areas where duties were performed incorrectly or infrequently. It was agreed that the most common mistakes occurred regarding area sign-ins, area clean-ups, and some occasional safety precautions, such as securely fastening children into high chairs, jump seats, swings, and so forth, despite the fact that rules for all of these procedures were posted visibly in each area. Performing these duties correctly is important (some, such as safety precautions, for obvious reasons), for, in addition to the staff's major responsibility for social interaction with children and ministering to their physical needs, they must record these behaviors for the parents' information.

Basic routines for areas in which recording must be done (diapering, feeding, sleeping) are as follows: (1) checking the child in on an appropriate area sheet prior to getting out supplies (laying out diapers, warming food, getting out crib blankets, and so on); (2) ministering to the child, then removing the child from the area; (3) cleaning the area; and (4) recording the appropriate data, such as sleep duration, amount of food consumed, etc. The precise sequencing of these duties serves a number of functions. Checking the child in prior to arrival is a formal signal that the staff member has taken responsibility for the area and the child, and is a necessary note of the time the activity began. Supply preparation and cleanup when the child is not in the area are safety precautions. Finally, all recording provides information for the parents. Additionally, in the play area, the staff member there signs in and out as another formal acceptance of responsibilities for this area.

Five such behaviors were selected for examination in the present study. Percentages of duties performed correctly were compared across conditions in which an observer and then the Supervisor monitored them, and in which the Supervisor provided graphic feedback to the staff on their performance.

Procedure

Each of the following duties was observed five times daily between the hours of 10 A.M. and 2 P.M. throughout all phases of the study, and are defined as follows:

1. Correct diaper sign-in was defined as the area manager checking the child in prior to getting out his supplies.
2. Correct feeding belt-in was defined as all children in the feeding area being belted into high chairs or infant seats.
3. For all cribs to be considered clean, each must be empty of blankets, crib mats, toys, and similar objects.

4. Correct feeding sign-in was defined as all children in the feeding area checked in prior to being brought into the area.
5. Correct play manager sign-in was defined as the scheduled play manager being signed in and present in the area.

During Phase 1, or the Observer-Monitored phase, an observer entered the Center and observed and recorded whether behaviors occurred correctly or incorrectly. (It should be pointed out that this Center was a research site in which staff were accustomed to frequent and varied data collection. They were familiar with the observers used in this study and did not indicate that they knew which, if any, behaviors or duties were being monitored.)

In the Second Phase of the study, or the Supervisor-Monitored phase, the Supervisor and the observer monitored the same duties simultaneously. The Supervisor was asked not to remind the staff of their correct duties at any time nor tell them they were being monitored. She was not observed to disregard these instructions.

During Phase 3, Graphic Feedback, the Supervisor presented graphs to the staff on daily percentages of correct performance and indicated that 100% correct was the desired performance level. She then displayed the graphs on a wall in the appropriate areas. The Supervisor and the observer continued to observe simultaneously, as the previous condition, but the Supervisor additionally plotted the data on wall graphs at the end of each day for the staff's benefit.

Introduction of the Supervisor-Monitored and Graphic Feedback conditions were staggered across days in multiple baseline fashion. That is, the Supervisor began monitoring duties at different points in time, and feedback for each duty was introduced on different days.

Reliability (number of agreements divided by total number of observations) between the Supervisor and the observer averaged 96% across all duties and all days of the study, with a range of 86-100%. Average percent of agreements between observer 1 and a second observer was 94%, with a range of 71-100%. (Reliability for each day and each duty, figured separately, were within the same level and range as overall reliability, for both pairs of observers.)

RESULTS

Percent correct on all behaviors was determined by dividing the number of times staff performed the duty appropriately by the number of opportunities for performing that duty that day. Figure 1 illustrates that use of these procedures had several results. For three of the behaviors observed, having the Supervisor simply monitor the behaviors produced changes in average daily percent correct: play manager sign in went from an average of 73% correct during covert observation to an average of 90% during overt observation, feeding belt-in from 20-49% correct, and crib cleaning from 54-90% correct across these two conditions. Percent correct in feeding sign-in remained essentially the same (78 and 77%), while percent correct for diaper sign-in dropped from an average of 67% to 56% correct.

Graphic feedback produced changes in performance in feeding sign-in (78 to 77 to 94%), diaper sign-in (67 to 56 to 93%), feeding belt-in (20 to 49 to 98%), and in crib cleaning (54 to 90 to 99%). Since play manager sign-in remained at a relatively high level, no feedback was introduced.

Insert Figure 1 about here

DISCUSSION

These results indicate several things: first of all, simply having the Supervisor monitor these duties herself, for some duties had the effect of increasing the percentage of time they were performed correctly. Crib cleaning was largely the duty of the Supervisor, so perhaps simply drawing her attention to it was responsible for some of that improvement. The improvement in feeding belt-in and play manager sign-in might simply be a function of the staff noticing the Supervisor was observing them, since she was more obvious about it than the observer, and than when she checked on the other duties. At any rate, it is clear from these data that, while simply having the Supervisor monitor staff duties has some effect in improving their performance of them, having her provide simple graphic feedback on this performance was effective in further improving it to near-perfect levels. It should also be pointed out that "errors" in performance during feedback conditions, in all but two instances, were made by new staff members still being trained.

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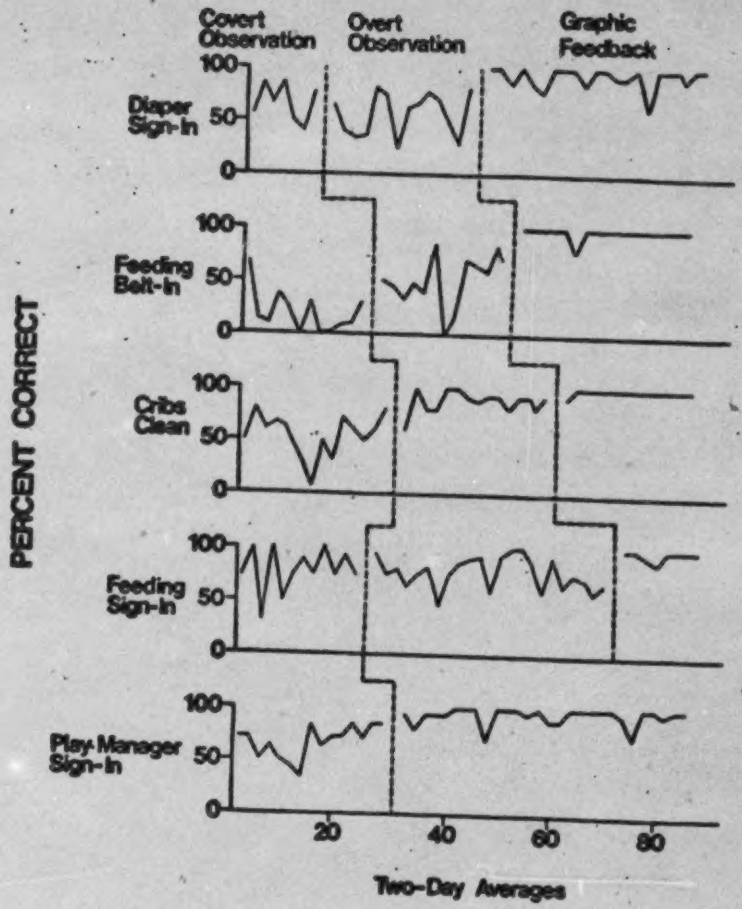
FOOTNOTES

1. This is a study conducted by the Living Environments Group at the University of Kansas, under the direction of Dr. Todd R. Risley. This research was done in partial fulfillment of the requirements for the degree of Doctor of Philosophy from the Department of Human Development, University of Kansas, and was supported in part by grants from the U.S. Office of Education to the National Program on Early Childhood Education and the University of Kansas' Kansas Center for Research on Early Childhood Education. The authors are grateful to the members of this group, especially Michael Cataldo, for their advice regarding important aspects of this research. The unswerving cooperation and assistance from Susan Woodhouse-Oestreicher, Center Supervisor, and Ruth Burris, Bob Davidson, Roberta Hensen, Jim Gilbert, Ho Soon Kim, and Patricia Pandzik, Center staff, were invaluable to the successful completion of these studies. Reprints may be obtained from Dr. Todd R. Risley, Department of Human Development, University of Kansas, Lawrence, Kansas 66044.

2. Now at the Department of Special Education, Yeshiva University, 55 Fifth Avenue, New York, New York 10003.

FIGURE CAPTION

Figure 1. Shown are percent of observations across each two days' duties which were performed correctly during conditions in which an observer monitored, one in which an observer and the Supervisor monitored, and graphic feedback to staff from Supervisor (observer and Supervisor monitored) on job performance. At hourly intervals, five times daily, the following were observed: (1) Child signed into diapering; (2) children belted into feeding chairs; (3) empty cribs clean of blankets, bottles, and so forth; (4) children signed into feeding; and (5) play manager signed in and present. The data illustrates that overt Supervisor monitoring had an effect for three behaviors, and that feedback produced increases in correct performance in all conditions in which it was introduced.



Covert Observation
Overt Observation
Graphic Feedback
PERCENT CORRECT
Diaper Sign-In
Feeding Belt-In
Cribs Clean
Feeding Sign-In
Play-Manager Sign-In
100
50
0
20
40
60
80
Two-Day Averages

Figure 1

Menus for Toddler Day Care: Food Preference and Spoon Use

Sandra Twardosz, Michael F. Cataldo, and Todd R. Risley[1]

ABSTRACT

Although information on the nutritional composition of meals is widely available and discussed, other characteristics of food are equally important--especially for very young children who are just beginning to learn about food and feeding skills. Toddlers' preference for foods and spoon use with various foods were investigated with a group of children 13 - 30 months of age. By measuring the amount consumed of a variety of main dishes, vegetables, and fruits and desserts, it was found that many of the most preferred foods were of a mushy consistency, and were often relatively inexpensive. By alternating meals consisting entirely of mushy foods with those consisting of chunky foods, it was shown that the level of spoon use can be overwhelmingly determined by the type of food served. These studies demonstrate that reliable determinations can be made of a food's preference value and its facilitation of the development of eating skills. These factors should be weighted equally with nutrition in planning meals for young children.

With greater numbers of children spending their days away from home in group care situations, attention has focused on providing them with the quality care of a good home. One of the basic components of quality care is, of course, nutrition. Recent studies have pointed to nutrition as probably the most important factor in determining a child's growth, functioning, and resistance to disease. Malnutrition and hunger not only may do long-term functional damage, but also produce behaviors that interfere with learning, i.e., apathy, lack of initiative, and irritability (Birch and Gussow, 1970; Birch, 1971; Scrimshaw and Gordon, 1968). It has also become apparent that day-care centers have the opportunity to correct poor home eating habits, since the child may spend up to ten hours per day there. The 1969 White House Conference on Food, Nutrition, and Health recommended that day-care centers provide 80% of the child's total nutritional requirements (Foster, 1972).

Various governmental agencies have recognized the importance of nutrition in day care by establishing guidelines for feeding children in group care situations. For example, the State of Alabama requires that children 1-3 years old must be offered a balanced noonday meal including fruit juice and milk, and that food cannot be withheld or forced. In Tennessee, children in a day-care center for four hours or longer must be provided a noon meal and one snack, meeting one-third to one-half the daily nutritional requirements; a meal and two snacks must be served if the child is there longer than eight hours (United States Department of

Health, Education, and Welfare, 1971a). Government programs are also concerned with the direct provision of food to hungry children (United States Department of Health, Education, and Welfare, 1971b).

Aside from nutrition, the importance of food and mealtime in the child's life has also been recognized. Dittman (1967) speaks of the importance of food in the physical, social, and emotional development of the child, and the opportunities provided to the child for the enjoyment of odors and textures, and learning table manners. Several authors have discussed the expected behavior of the teacher at mealtime, the establishment of standards for finishing food, the size of the servings (Read, 1966), practical problems concerning the preparation and storage of food, and the responsibility of the day-care director in regard to nutrition (Evans and Saia, 1972).

Although much has been written about the behavior and feelings of young children at meals and how this daily event should be conducted, there has been little formal observation of what children actually do during meals. What foods are preferred at various ages, how much is consumed, and how table manners actually are acquired have not been systematically investigated. Information on the types of foods preferred by children would be extremely beneficial to children, to day-care programs, and to parents. If the only foods served were nutritious ones which children preferred, not only would the children benefit by eating what was prepared, but waste would be minimized--a must for our nation's minimally financed day-care programs.

With these considerations in mind, we designed a study to measure how many ounces of each food served at lunch were consumed by a group of very young children in a day-care center. During the course of the study, it became clear that meals could be planned to encourage spoon use, one of the first table manners a child learns.

The Toddler Center and Lunch Routine

The Toddler Center of the Lawrence Day Care Program, associated with the Department of Human Development at the University of Kansas, was established to develop a technology for caring for groups of up to 20 children from walking to preschool age with four staff members. The Toddler Center is an extension of a similar program to develop such a technology for caring for groups of infants (Cataldo and Risley, in press).

Insert photograph of meal about here

At the Toddler Center, a staff member prepares and serves the food to correspond to a list of menus prepared by the staff (originally in consultation with a nutritionist at the University of Kansas) and given to the parents at the beginning of each month. The lunchroom is furnished with colorful child-sized tables and chairs, such that eight children can eat at once. Partitioned plastic dishes, small plastic cups or glasses, and regular teaspoons are used. The children enter individually after having their hands washed, are helped into their chairs by the staff member, and begin eating. Portions of each food have already been placed on their plates, so the children do not have to wait after being seated. Although staff occasionally suggest that a child sample a food, no one is prodded or forced to eat. After the children have eaten the first portion of a food, they receive seconds, usually after requesting them. Generally they indicate when they have finished by saying "all done" or getting up and leaving the table, but a staff member may decide that a child is done if he is not eating and just playing with the food. If a child wishes to help clean up, the staff member helps him take his plate to the dishpan before he proceeds to the bathroom.

Sixteen different children ranging in age from 13-30 months participated in the studies. A mean of 12 children were present at lunch each day.

STUDY I - DETERMINING FOOD PREFERENCES

METHOD

Menus

A sample menu for one week is presented in Table I. Each main dish was served a median of three times, each vegetable a median of four times, and each fruit or dessert a median of three times during the study in combination with different foods. (For example, peas were served with different combinations of main dishes and fruits or desserts.) All of the main dishes, vegetables, and fruits or desserts served are listed in Figures 1, 2, and 3. The study lasted 72 days.

Insert Table I about here

Weighing the Food - Before the Meal

After the food was prepared, but before it was placed on the children's plates, each type of food, including milk, was weighed in its pan or container. The containers had been weighed before the study so that each had a standard weight attached. The weight of the food and container minus the weight of the container was the weight prepared for the children.

Weighing the Food - After the Meal

All of the food that had not been consumed by the children was weighed. Food remaining in the serving dishes was weighed, and the weight of the containers subtracted. Then, all of the leftovers from the children's plates, the tables, chairs, and floor were separated into the various types of food and weighed. The amount of food left over was equal to the weight left in the serving dish and the weight from the children's plates, furniture, and floor. The weight of food consumed by the children was obtained by subtracting the weight left over from the weight served. This value was obtained for each type of food served, and was divided by the number of children who had eaten that day. (Two children were allergic to various foods served and were not included in the calculations if they had not been served that food.)

Weighing Individual Servings Before the Meal

In order to be able to compare the amount consumed of various foods of one category (i.e., be able to say that more peas were eaten than okra), it was necessary to serve each child the same weight of a food type each day. Therefore, each child always received 2 ounces of the main dish, 1 ounce of vegetable, 1 ounce of fruit or dessert, and 3 fluid ounces of milk. The observer determined the serving by weighing the appropriate amount for an individual serving and then determining how many spoonsful were required to serve this weight of food. Several individual servings were then made up in this way and weighed. A sign was put up for the staff in the lunchroom displaying the amount of each food to be given when serving additional portions.

Serving Additional Portions

After a child finished any food, a second helping of the same amount as the first was placed on his plate, usually in response to the child's request. However, even if the child had not asked, he received seconds. Third helpings were not given until a child had eaten everything on his plate. If a child asked for seconds or thirds but could not receive them (for example, if he asked for a second helping of a food when part of the first helping was still on his plate), the staff member told the child that he should first finish what was on his plate, and could then have more. Staff members recorded the number of helpings of each food each child had.

Taste Checks

To determine if the children had at least tasted each food served, the observer looked at each child and his plate for 15 seconds every five minutes during the meal. Each food that had at least been tasted was recorded. The observer used various cues to ascertain which foods had been tasted, i.e., seeing the child taste the food, the child's face smeared with the food, food gone from the child's plate (if it had not been thrown on the floor), or the child's receiving seconds. Percentage of children who had tasted each food was computed by dividing the number who had tasted a food by the number who had been served that food.

Reliability Procedures

In order to determine if two people could agree on the amount of food consumed, a second observer independently weighed the food 15 times throughout the study. This was done by having both observers perform all of the weighing operations one after the other (i.e., the first observer weighed all the food before the meal, then the second observer weighed all the food, etc.). To insure that this occurred as independently as possible, after the first observer had weighed the leftovers, she returned the food scraps to the children's plates and the floor of the lunchroom for the second observer. Several different pairs of observers weighed the food together throughout the study. Observers agreed an average of 95% per check on these weights.[2] Similarly, observers simultaneously but independently recorded what foods the children had tasted 12 times during the study. Observers agreed an average of 81% per check on the number of children who had tasted each food.[3]

RESULTS

Figures 1, 2, and 3 show the ounces consumed per child of the main dishes, vegetables, and fruits and desserts. It can be seen that the children ate larger portions of main dishes which can be called "mushy", i.e., soups, noodle-based casseroles, and scrambled eggs. Nine of the "top ten" foods can be classified as soft and mushy (the only exception being hot dogs). In contrast, none of the ten least consumed foods were "mushy". Similarly, six of the top ten fruits or desserts were soft and mushy, whereas none of the last eight were of this consistency. Although only two of the vegetables served (baked beans and creamed corn) could be described as mushy, these were the two most preferred vegetables. On the average, each child consumed 7.7 ounces of food (including milk) at lunch.

Insert Figs. 1, 2, & 3 about here

Pearson product-moment correlations performed on the amount consumed and the percentage of children who tasted the foods revealed that there were moderate positive relationships for the main dishes (+ .35) and fruits and desserts (+ .51). However, there was a large positive relationship (+ .89) between amount eaten and percentage who tasted vegetables, i.e., a larger percentage of children tasted those vegetables of which more was consumed. These results indicate that, although which vegetables are tasted may serve as an indicator of which will be preferred, this is not the case with main dishes or fruits and desserts, where measurement of amount consumed is necessary.

Food Value and Cost Related to Preference: Some Examples

Although children's food preferences are very important in planning menus, nutrition is the prime consideration. During this study, meals of low nutritive value (for example, noodles and butter served with applesauce and bread) were not prepared, so we cannot tell what amounts of these foods would be consumed. However, we can compare a few of the main dishes to illustrate that the amount consumed does not necessarily indicate food value received. For example, while on the average, children consumed more than twice as much chicken and noodles as they did chicken (3.5 oz. as compared to 1.4 oz.), the useable protein supplied by these average servings is 6 grams for the chicken and only 4.9 for the chicken and noodles. Similarly, 3 oz. of tuna noodle casserole provides 5 grams protein, whereas only 1.5 oz. hamburger provides 7.4 grams.[4]

Cost, of course, must also be considered in planning menus for day-care centers, and may unfortunately even take precedence because of limited funds for day care. In this study, some of the foods prepared were quite expensive, and some were relatively inexpensive. A cost analysis was performed to see if any relationship existed between the cost of a dish and the amount consumed.[5] Figures 4, 5, and 6 show the prices per ounce of the main dishes, vegetables, and fruits and desserts. The foods are arranged in the order in which they were preferred by the children. Pearson product-moment correlations performed on the amount of a food consumed and the cost per ounce showed that there was a slight negative relationship (- .19) for vegetables, a moderate negative relationship (- .60) for fruits and desserts, and a large negative relationship (- .85) for main dishes. Thus, particularly for main dishes, the more expensive a food was, the less the children ate.

Figs. 4, 5, & 6 about here

STUDY II - RELATIONSHIP BETWEEN TYPE OF FOOD AND SPOON USE

METHOD

Measuring Spoon Use

Throughout the food preference study (Study I), an observer recorded each child's spoon use during lunch. Spoon use was defined as the child's moving food from his plate to his mouth with a spoon. A complete circuit from plate to mouth had to occur (O'Brien and Azrin, 1972). However, hands could be used to help get food onto the spoon. Hand use was defined as moving food a complete circuit from plate to mouth with the hand. Each child was observed for thirty seconds until all children had been observed, then each was observed again, and so on until they left the lunchroom. Each occurrence of spoon or hand use was recorded, as was the type of food that had been eaten with spoon or hand. The percentage of each type of food consumed with a spoon was computed by dividing the number of times each food was brought to the mouth with a spoon by the number of times it was brought to the mouth with spoon or hand. Foods such as sandwiches, which are appropriately eaten with the hands, were eliminated from the data.

In order to determine if two people could agree on spoon or hand use and the type of food for each, two observers watched the children simultaneously and independently recorded the behavior 21 times throughout the study. Several different pairs of observers recorded the behavior together. Observers agreed an average of 93% per check on the percentage of spoon use.[6]

RESULTS

Figure 7 shows the percentage of each type of food consumed with a spoon. There is a very large range, from a high of 89% spoon use with split pea soup, to zero for pineapple. As can be seen, foods of a mushy consistency (i.e., soups, applesauce, pudding) were eaten with a spoon more often than chunky foods (i.e., peaches, hamburger, green beans) which are easily picked up with the hand. Staff did not prompt spoon use with any foods.

Insert Fig. 7 about here

The relationship between the consistency of a food and the amount it was eaten with a spoon occurred across the various ages of children at the toddler center. Pearson product-moment correlations were performed on the spoon use per food for the two youngest, two middle and two oldest children at the center, and the data for the group (presented in Figure 4). These correlations ranged from +.40 for the youngest child (16 mos.), to +.81 for the oldest (30 mos.). Values for the other four children (19 to 27 mos.) ranged from +.63 to +.78. Thus, even the youngest children's spoon use was considerably determined by the type of food served.

STUDY III - THE DELIBERATE PLANNING OF MENUS AS A MEANS OF ENCOURAGING SPOON USE

Study II showed that some foods were eaten more frequently with a spoon than others. This study was conducted to demonstrate the extent to which the type of food served affects level of spoon use by deliberately planning meals either to encourage or to discourage spoon use.

METHOD

Menus and Experimental Conditions

Table 2 presents a sample menu of a meal consisting entirely of spoon foods, or those which a high probability of being eaten with a spoon, and of a finger meal, or foods with a low probability of being eaten with a spoon. Foods considered spoon foods were those which Study II showed were eaten with a spoon at least 50% of the time, i.e., applesauce, soups, and puddings. (Occasionally, cottage cheese was included in a spoon meal even though it was not a high spoon use food in order to make the meal nutritionally balanced.) Foods considered finger foods were those which were eaten with a spoon less than 50% of the time, i.e., macaroni and cheese, green beans, cherries. All of the foods selected are appropriately eaten with eating utensils rather than hands.

Insert Table 2 about here

The study lasted 22 days. On 10 days a spoon meal was served, and finger meals were served on 12 days. Each day a coin was tossed to determine the type of meal served. The procedures for determining individual servings and giving additional portions were the same as during the previous studies.

Measuring Spoon Use and Weighing Food

Spoon use was measured as during the previous study, i.e., defined as a complete circuit from plate to mouth with the spoon, and computed in the same way. Two observers recorded the data simultaneously but independently five times during the study. Several different pairs of observers were used. Observers agreed an average of 92% per check on the percentage of spoon use, computed as in the previous study.

Six times during the study, for three spoon and three finger meals, the amount of food consumed per child was determined as during Study I. On one of these days a second observer also weighed the food.

RESULTS

Figure 8 shows the percentage of food consumed with a spoon. On days when spoon meals were served, spoon use averaged 59.8%, whereas on days when finger meals were served, spoon use averaged only 12.8%. Moreover, each of the thirteen children who participated in this study used their spoons much more frequently when spoon meals were served. The youngest child in the group, who was 16 months old, used her spoon 21% of the time when spoon meals were served, but only 4.8% when finger meals were served. For the next youngest, 19 months, the figures were 90.1% and 19.6%. It is interesting that the oldest child in the group, who was 30 months old, used her spoon very seldom in either condition, i.e., 9% with finger meals, and 18.3% with spoon meals. Average ounces consumed per child of spoon meals was 9.5, and of finger meals, only 6.1 ounces. Thus, without prompting or adult intervention of any kind, menus can be constructed such that spoon use will occur most of the time or almost none of the time.

Insert Fig. 8 about here

DISCUSSION

Many of the foods the children at the toddler center most preferred were of a soft, mushy consistency, and were often relatively inexpensive. Children were also observed to use their spoons more often when eating "mushy" foods than when eating "chunky" foods, and it was shown that spoon use by toddlers can be overwhelmingly determined by the type of food served.

When the results of the food preference and spoon use studies are considered together, it is apparent that certain foods are both preferred by the children and eaten at least half the time with a spoon. For example, three of the five most preferred main dishes were eaten with a spoon most of the time, but none of the five least preferred were. The two most preferred vegetables were the only two that encouraged a high rate of spoon use, and two of the top five fruits and desserts were also eaten a great deal with a spoon. Thus, certain foods may be particularly appropriate for encouraging a high rate of spoon use because the children also eat a large amount of them. In Study III, when spoon and finger meals were served on alternate days, the children consumed more than a third more when spoon (mushy) meals were served.

The fact that spoon use, even for very young children, can be increased by serving specific types of foods is particularly relevant for group care settings. When many young children must be fed at once, staff may be so busy wiping milk spills and serving additional portions that there is little time for modeling eating skills, or for giving each child individual attention. Planning menus to include many foods which prompt spoon use can encourage the development of this skill without involving staff time.

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FOOTNOTES

1. This is one of a series of projects conducted by the Living Environments Group at the University of Kansas under the direction of Todd R. Risley. The authors wish to particularly thank Martha Bedlington and Carol Siegele for their assistance during the study. This program is supported in part by grants from the U. S. Office of Education to the National Program on Early Childhood Education and to the University of Kansas' Kansas Center for Research on Early Childhood Education. The first author was partially supported by a fellowship from the Graduate School at the University of Kansas, and the preparation of the manuscript was partially supported by the Johnny Cake Child Study Center. Reprints can be obtained from Dr. Todd R. Risley, Johnny Cake Child Study Center, Mansfield, Arkansas 72944.

2. A reliability estimate was calculated for each food by dividing the smaller number of ounces consumed by the larger, as recorded by the two observers. For example, if Observer 1 said that 1.5 ounces of hamburger had been consumed per child and Observer 2 said 1.4 ounces had been consumed, the reliability estimate would be 93%.

3. A reliability estimate was computed for each food by dividing the smaller number of children who had tasted the food by the larger, as recorded by the two observers.

4. Information on grams of usable protein was obtained from Diet for a Small Planet by Frances Moore Lappe. New York: Ballantine Books, Inc., 1971. Grams of protein for chicken and noodles, and tuna noodle casserole were calculated by adding the grams of protein in the separate ingredients relative to the proportion present in the dish.

5. Price per ounce was determined for vegetables and most fruits or desserts by selecting cans or packages (of the least expensive variety) sufficient to serve 15 children, and dividing the price by the number of ounces. The price of dishes containing more than one ingredient was determined by adding together the cost per ounce for each ingredient relative to the proportions present in the dish.

6. Reliability estimates were computed as follows: For each 30 second observation of a child, the number of times one observer said the spoon was used for a particular food was compared with the record of the second observer. If one observer said the child used the spoon 5 times for soup and the second said 4 times for soup, reliability was 80%. Moreover, if the observers agreed that the spoon was used but disagreed on the food the spoon was used for, this was considered a disagreement.

TABLE 1

Sample Lunch Menus

Day 1

- Chicken
- Baked beans
- Pears
- Milk

Day 2

- Eggs and hot dogs
- Brussels sprouts
- Oranges
- Milk

Day 3

- Spaghettios
- Spinach
- Peaches
- Milk

Day 4

- Eggs à la goldenrod
- Okra
- Plums
- Milk

Day 5

- Tomato and rice soup
- Corn
- Vanilla pudding
- Milk

TABLE 2

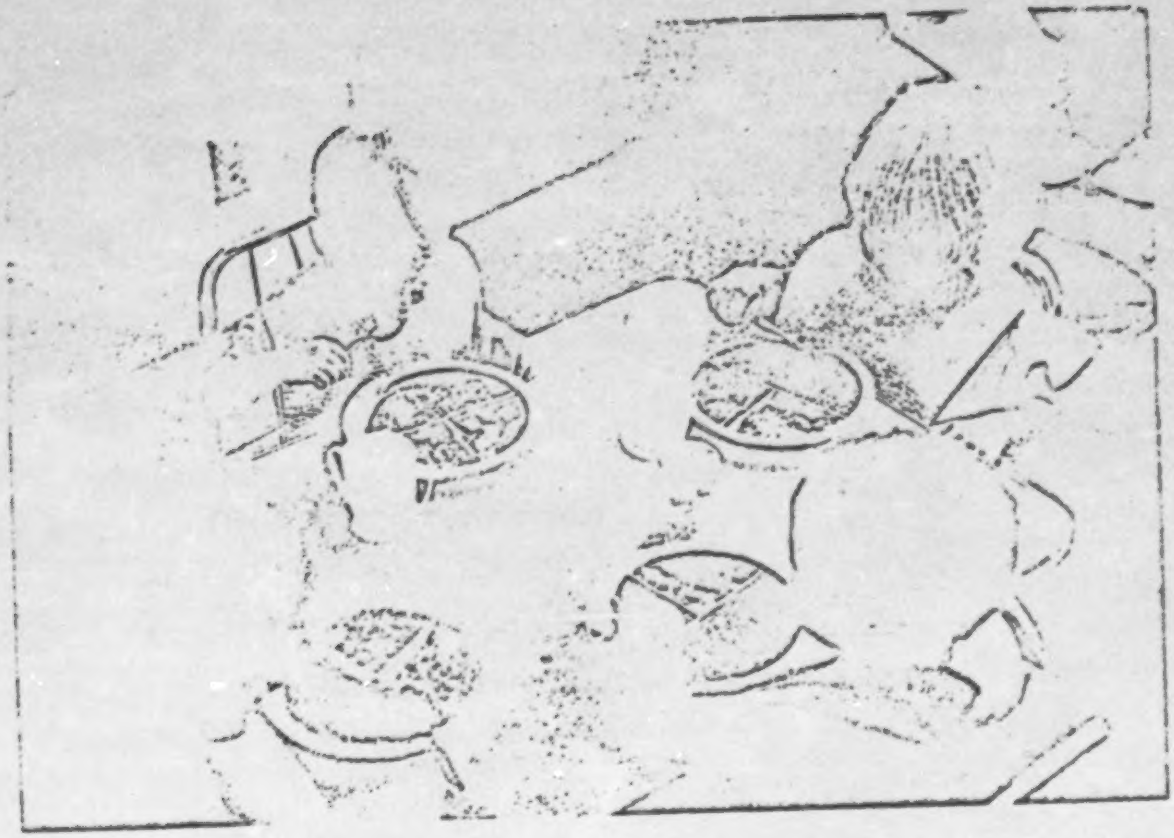
LUNCH MENUS

Sample Spoon Meal

- chicken vegetable soup
- baked beans
- ice cream
- milk

Sample Finger Meal

- boiled eggs
- corn
- fruit cocktail
- milk



Photograph

FIGURE CAPTIONS

Fig. 1. Oz. consumed per child of main dishes served to a group of toddlers. Main dishes are arranged in descending order of preference.

Fig. 2. Oz. consumed per child of vegetables served to a group of toddlers. Vegetables are arranged in descending order of preference.

Fig. 3. Oz. consumed per child of fruits and desserts served to a group of toddlers. Fruits and desserts are arranged in descending order of preference.

Fig. 4. Price per oz. of main dishes served to a group of toddlers. Main dishes are arranged in their order of preference.

Fig. 5. Price per oz. of vegetables served to a group of toddlers. Vegetables are arranged in their order of preference.

Fig. 6. Price per oz. of fruits and desserts served to a group of toddlers. Fruits and desserts are arranged in their order of preference.

Fig. 7. Percentage of spoon use per food for the main dishes, vegetables, and fruits and desserts served to a group of toddlers. Foods are arranged in descending order of spoon use.

Fig. 8. Percentage of spoon use per meal when menus were deliberately planned to encourage or discourage spoon use. Spoon meals consisted entirely of foods previously observed to be eaten with a spoon more than 50% of the time. Finger meals consisted entirely of foods eaten with a spoon less than 50% of the time.

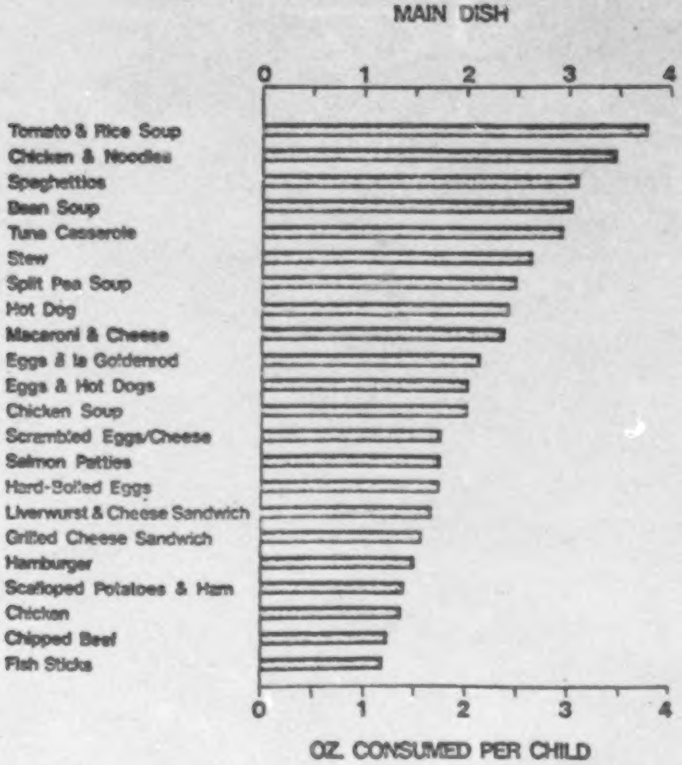

MAIN DISH
0
1
2
3
4
Tomato & Rice Soup
Chicken & Noodles
Spaghettios
Bean Soup
Tuna Casserole
Stew
Split Pea Soup
Hot Dog
Macaroni & Cheese
Eggs à la Goldenrod
Eggs & Hot Dogs
Chicken Soup
Scrambled Eggs/Cheese
Salmon Patties
Hard-Boiled Eggs
Liverwurst & Cheese Sandwich
Grilled Cheese Sandwich
Hamburger
Scalloped Potatoes & Ham
Chicken
Chipped Beef
Fish Sticks
OZ. CONSUMED PER CHILD

Fig. 1

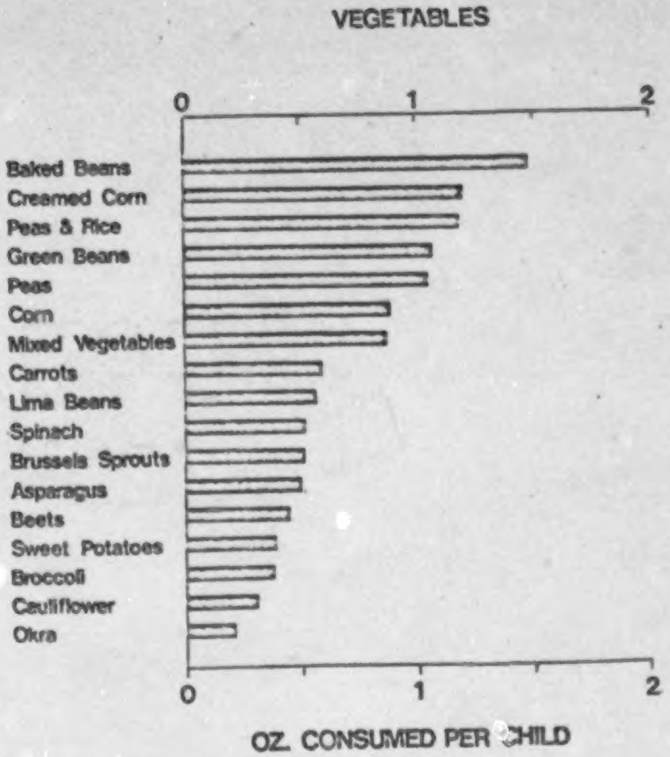

VEGETABLES
0
1
2
Baked Beans
Creamed Corn
Peas & Rice
Green Beans
Peas
Corn
Mixed Vegetables
Carrots
Lima Beans
Spinach
Brussels Sprouts
Asparagus
Beets
Sweet Potatoes
Broccoli
Cauliflower
Okra
0
1
2
OZ. CONSUMED PER CHILD

Fig. 2

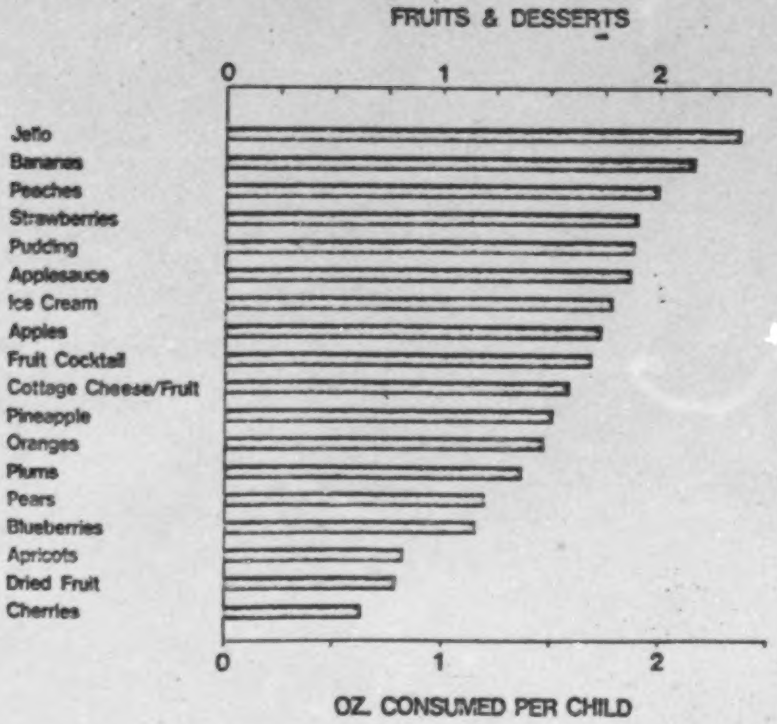
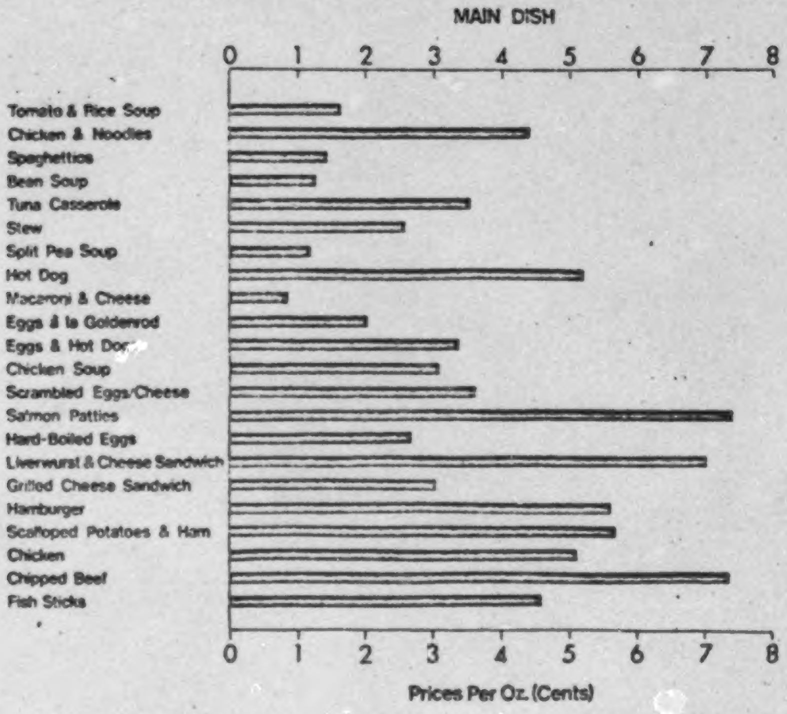

FRUITS & DESSERTS
0
1
2
Jello
Bananas
Peaches
Strawberries
Pudding
Applesauce
Ice Cream
Apples
Fruit Cocktail
Cottage Cheese/Fruit
Pineapple
Oranges
Plums
Pears
Blueberries
Apricots
Dried Fruit
Cherries
0
1
2
OZ. CONSUMED PER CHILD

Fig. 3


MAIN DISH
0
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2
3
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5
6
7
8
Tomato & Rice Soup
Chicken & Noodles
Spaghettios
Bean Soup
Tuna Casserole
Stew
Split Pea Soup
Hot Dog
Macaroni & Cheese
Eggs à la Goldenrod
Eggs & Hot Dogs
Chicken Soup
Scrambled Eggs/Cheese
Salmon Patties
Hard-Boiled Eggs
Liverwurst & Cheese Sandwich
Grilled Cheese Sandwich
Hamburger
Scalloped Potatoes & Ham
Chicken
Chipped Beef
Fish Sticks
Prices Per Oz. (Cents)

Fig. 4

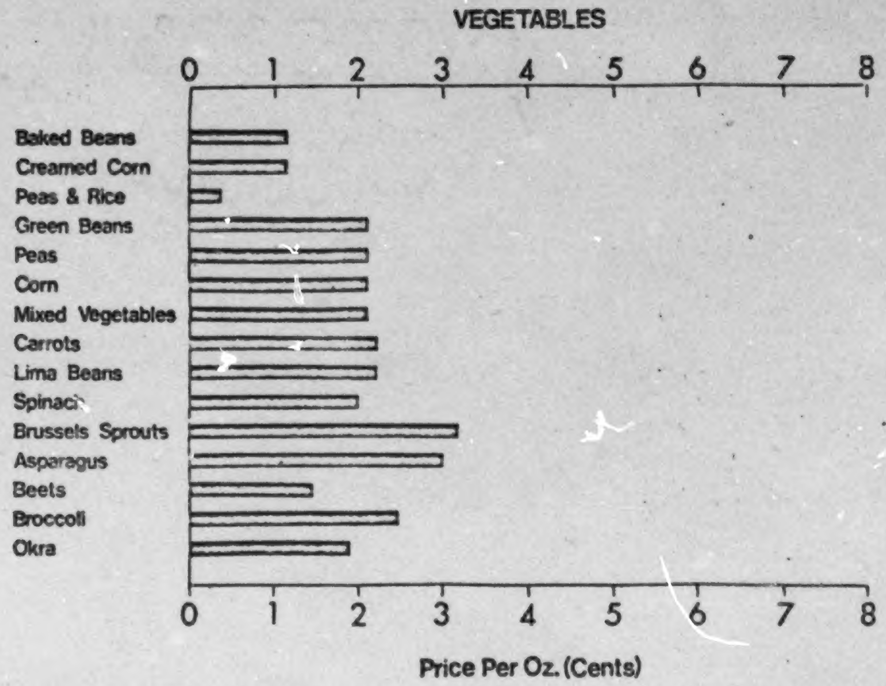
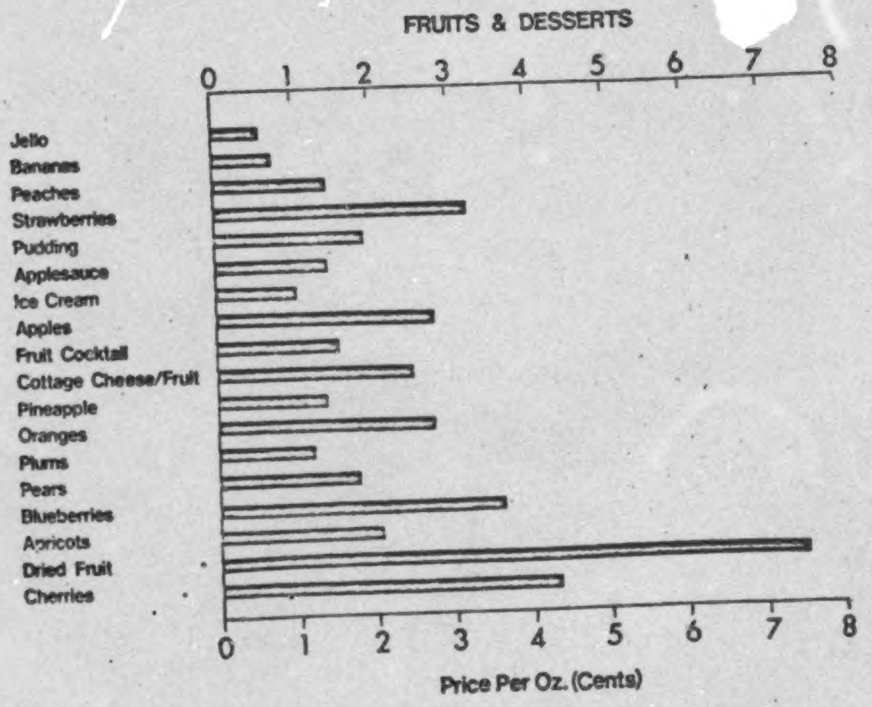

VEGETABLES
0
1
2
3
4
5
6
7
8
Baked Beans
Creamed Corn
Peas & Rice
Green Beans
Peas
Corn
Mixed Vegetables
Carrots
Lima Beans
Spinach
Brussels Sprouts
Asparagus
Beets
Broccoli
Okra
Price Per Oz. (Cents)

Fig. 5


FRUITS & DESSERTS
Jello
Bananas
Peaches
Strawberries
Pudding
Applesauce
Ice Cream
Apples
Fruit Cocktail
Cottage Cheese/Fruit
Pineapple
Oranges
Plums
Pears
Blueberries
Apricots
Dried Fruit
Cherries
0
1
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3
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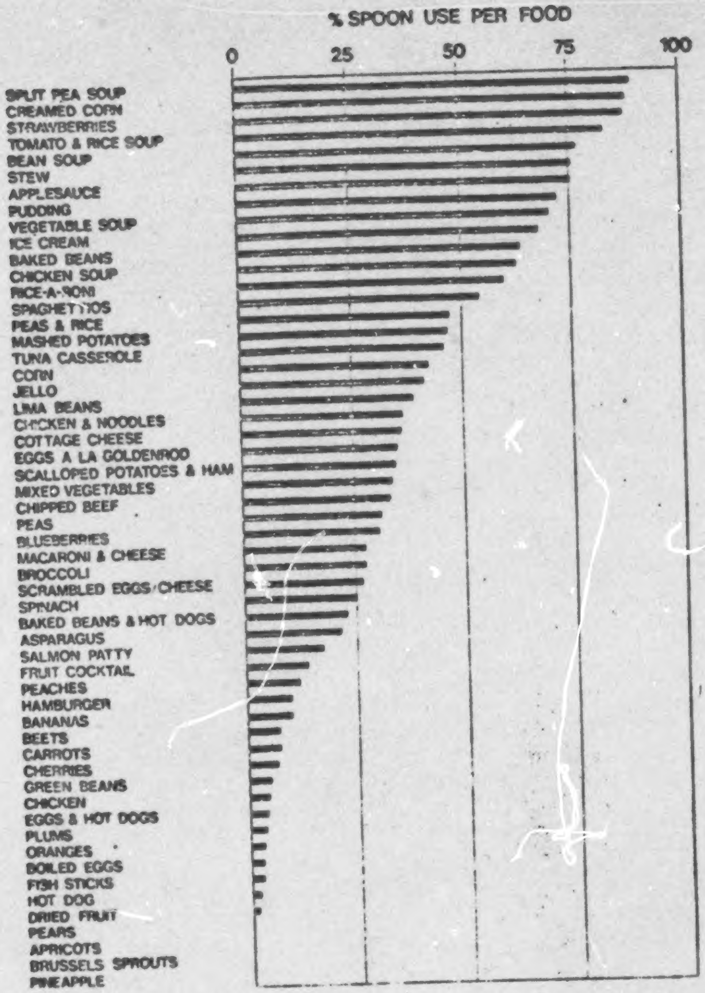
5
6
7
8
Price Per Oz. (Cents)

Fig. 6



% SPOON USE PER FOOD
0
25
50
75
100
SPLIT PEA SOUP
CREAMED CORN
STRAWBERRIES
TOMATO & RICE SOUP
BEAN SOUP
STEW
APPLESAUCE
PUDDING
VEGETABLE SOUP
ICE CREAM
BAKED BEANS
CHICKEN SOUP
RICE-A-RONI
SPAGHETTIOS
PEAS & RICE
MASHED POTATOES
TUNA CASSEROLE
CORN
JELLO
LIMA BEANS
CHICKEN & NOODLES
COTTAGE CHEESE
EGGS A LA GOLDENROD
SCALLOPED POTATOES & HAM
MIXED VEGETABLES
CHIPPED BEEF
PEAS
BLUEBERRIES
MACARONI & CHEESE
BROCCOLI
SCRAMBLED EGGS/CHEESE
SPINACH
BAKED BEANS & HOT DOGS
ASPARAGUS
SALMON PATTY
FRUIT COCKTAIL
PEACHES
HAMBURGER
BANANAS
BEETS
CARROTS
CHERRIES
GREEN BEANS
CHICKEN
EGGS & HOT DOGS
PLUMS
ORANGES
BOILED EGGS
FISH STICKS
HOT DOG
DRIED FRUIT
PEARS
APRICOTS
BRUSSELS SPROUTS
PINEAPPLE

Fig. 7

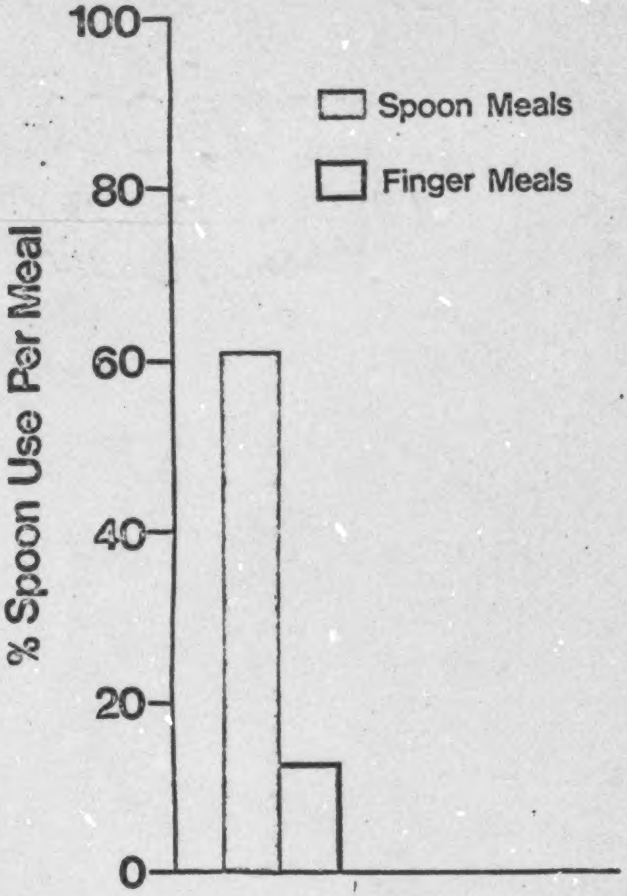


Fig. 8

KANSAS CENTER FOR RESEARCH IN EARLY CHILDHOOD EDUCATION

Individual Differences and Discriminative Abilities in Newborn and Young Infants

Frances D. Horowitz
Principal Investigator

a. The Assessment of Infants from Birth to One Month

c. Evaluation of Early Development with the Brazelton Scale - Effects of Obstetrical Medication

1973 SRCD PAPER
Philadelphia, Pennsylvania

AMERICAN AND URUGUAYAN INFANTS: RELIABILITIES, MATERNAL DRUG HISTORIES AND POPULATION DIFFERENCES USING THE BRAZELTON SCALE[1]

Frances Degen Horowitz, Malca Aleksandrowicz, L. Jennifer
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Most infant test constructors have all but given up the search for a test that can provide us with confident predictions about later developmental status over long spans of time. For a variety of artifactual and possibly intrinsic reasons the odessy has yielded little. Yet the interest in early infant assessment has not abated. But, it has turned to a different kind of question. The question reflects the growing appreciation that it is the environment interacting with the organism that ultimately makes the difference in outcome (See Sameroff and Chandler, in press; Scarr-Salapatek, in press; Horowitz, 1969). The question is deceptively simple: Can early assessment identify stable infant characteristics and do these characteristics determine those aspects of the environment that will be functional for infant development or for later development? There are two immediately obvious problems in using infant assessment to answer this question. One concerns the natural rhythms of changing physiological and behavioral functioning of the neonate in the adjustment to extra-uterine life. These adjustment processes may produce intrinsic individual variability from one day to the next. The second problem concerns the impact of environmental events just prior to and at birth as they increase, or decrease, the variability in the adjustment process in unknown but systematic ways so that the variability is either distorted, masked or changed.

In our collaboration with Dr. T. Berry Brazelton on the development of the Brazelton Neonatal Scale we became interested in the degree to which the Scale would yield reliable day to day assessments over the early days of life. Because of the evidence presented by Conway and Brackbill (1970) and others (Brazelton, 1961, Kron, Stein, and Goddard, 1966; Stechler, 1964) we were also interested in the effects of obstetrical medication on the behaviors measured by the Brazelton Scale. The research was planned in collaboration with Drs. Brazelton and Tronick and a comparable set of data are now being collected in the Boston area to compare with the data that we have collected in the frontier land of eastern Kansas. The amount of data we want to report today is large and some of the analyses extensive so let us proceed immediately to the basic design of the research. It will quickly become apparent that the research required the generous cooperation of the nursing and medical staffs of the hospitals in which we worked and we owe them an enormous debt of gratitude for their help and interest.[3]

Method

The overall design of the research involved testing each infant in the sample of eight separate days - days 1-5 consecutively, day 7, day 10, and at one month of age, approximately 28 days. From the beginning we intended to take obstetrical medication into account but we remained blind to this factor until all testing had been completed. Seven trained testers worked in two hospitals; to the extent possible no infant was tested two consecutive times by the same tester. No communication about particular infants was allowed between testers.

At the same time as data were being gathered in Kansas a sample of infants was being tested in Montivedeo, Uruguay. Eight repeated testings turned out not to be feasible but a total of 92 infants, each tested once, were seen. We will review the subjects, procedures and results of the Kansas sample first and then make some comparisons with the results from the Uruguayan sample.

Subjects

Fifty infants were originally taken into the Kansas sample, but three males and three females were dropped because of incomplete testing, with a resulting sample of 44 infants, 26 females and 18 males.

The mean birth weight for females in the study was 7 lbs, 14.5 oz., and for males it was 8 lbs., 2 oz. Age of mothers and birth order distribution for males and females were similar (Mean age of mothers for males was 25.2 years with a range of 17-37 years; mean age of mothers for females was 24.5 years with a range of 18 to 33 years.) Socio-economic status was judged by father occupations ranging from unskilled worker to professional and student with the sample weighted toward the educated middle class.

Procedure

Written final consent was obtained from the mother prior to the first testing of the infant. Once the infant was judged relatively stable by the nursing staff a member of the infant research team was called and the first test occurred within the first 24 hours (mean of 16.22 hours with a range of from 7.5 to 23 hours). Thereafter testing proceeded at 24 hour intervals to the extent possible until the infant went home. Testing in the home was done at the convenience of the mother. Each infant was tested by at least three different testers according to the standard procedure called for in the administration of the Brazelton Neonatal Scale (see Brazelton, et. al., in press). After all testing had been completed on the entire sample, medical data with regard to obstetrical medications were copied from hosptial records.

On all days the Test was administered in accordance with standard procedure to the extent possible (see Brazelton, et. al., in press, for full details of procedure of administering the Test). This involves beginning the test procedure with the infant in a sleep state. This was not always possible and therefore on some days for some babies, items requiring the sleep state were omitted.

The seven trained testers had each previously been trained to reliability at .90 or better. Assignment of testers was influenced by a number of factors including time of birth of the infant, number of babies to be tested on a specific day, weather, and illness. Each baby was tested by at least three different testers among the seven and some infants were seen by four or more testers. Testers had direct contact with mothers for the first time on the fourth or fifth day post partum just before the mother and infant left the hospital.

Medical data were taken from hospital records by a member of the infant research team who had not been involved in any testing and after all of the infant testing was completed. This resulted in a very uneven distribution of subjects within different drug groups. The obvious disadvantages of this result were forseen but for a number of reasons we had to elect the procedures we used.

Results and Discussion

To our knowledge this study involves the most extensive testing and retesting of infants with the Brazelton Scale. There are, obviously, numerous questions that can be answered by successive cullings of the data. To date, we have completed a few major analyses and the outcomes of these will be reported relative to two major topics. The first concerns the relationship among test items and repeated testings and the second concerns the effects of obstetrical medication on the behavioral course of the infants over the first month of life.

Descriptive Data, Intercorrelations, and Factor Analyses[4]

Table I shows the means and standard deviations for each item on each day of testing. Though we have included sex as a factor in all of our analyses, so far, it has not been either a significant main factor or a significant interaction in any of the results.

Insert Table I about here

Each item on the Scale for each day was correlated with every other item. The matrix of significant correlations was large and the number of significant item correlations increased over days going from 68 on Day 1 to 211 on Day 10. Many of these significant correlations were in the 80s and 90s. This finding suggests that there is a fair amount of redundancy in the test and corroborates analyses of earlier versions of the test (see Super, unpublished report, 1972). This result is not surprising because the test involves repeated assessment of similar types of behaviors and a particular behavioral observation may be used in the scoring of more than one item. The advantages and disadvantages of this will be discussed later.

Tables 2A thru 2H show the factor loadings of items for each test day. These were derived from a principal components factor analysis

Insert Tables 2a thru 2H about here

followed by a normal varimax rotation. The results of the factor analysis reiterate the redundancies in the test and describe some of the development changes across days.

Some of the redundancies are quite robust across days and the increasing organization of the infants behavior is reflected in the decrease in factors across days - from 10 on day 1 to seven at one month. The first and most stable factor involves those items that measure responsiveness to auditory and visual stimulation. Sometimes item 15 loads into this factor, Defensive movement to a cloth placed over the eyes and nose of the infant.

On Day 1, 10 factors were identified but the number of factors declines to nine and then to eight and then to seven, then is at eight through day 10. At four weeks of age there are seven factors. Several of the clusters of items that make up the factors are easily "named". The first and most stable factor across days are items 5, 6, 7, 8, 9, and 10. Each of these measures responsiveness to visual and auditory stimuli with item 10 being a general alertness measure. On the intercorrelation matrices all of these items are highly correlated. Other items load into this factor on different days with the most frequent addition being item 15, Defensive Movements. Defensive movement is scored following placement of a cloth over the infant's nose and observing the reaction to this stimulus. Its relation to the altertness items is reasonable.

A second factor that emerges with some consistency has at its hub items 17, 18, 19, and 24. These are peak of excitement, rapidity of buildup, irritability, and lability of state. It might be called "reactivity". Sometimes consolability loads into this group. After the first two factors there is more variability but two additional factors tend to reappear. One involves the first three items, sometimes joined by the fourth item. These are all habituation items. The second involves items 25, which appears in conjunction with 26, or 27 or both. These items are self-quieting activity, hand-to-mouth facility and smiles. Of the seven factors that appear at one month of age, the four identified just now are among them. They might be named: Responsivity, reactivity, habituation, and state control. Two other items,startle and temulousness appeared alone as factors on Days 10 and 28, respectively. Tremulousness at 28 days may have some import with respect to the drug data. Further analyses remain to be done regarding "over-days" changes that should illuminate the development uses of the Scale.

Drug Related Findings

The analyses of our results in relation to obstetrical medication has proceeded in two ways. The first was to form five different drug groups according to criteria used by Brazelton ranging from Group 0 no drugs to Group IV, general anesthesia as shown in Table A.

Insert Table A about here

The distribution of cases in the groups is very uneven and the number of no drug cases was disappointingly small. The analysis of the data in terms of these five groups is still in the computer, but we have drawn the graphs and some trends are suggested. The strongest result appears to be on the orientation or responsivity items in which the most heavily drugged group - general anesthetic show generally depressed performance over the first four days with the exception to animate auditory stimuli. These results are graphed in Figures 1-6.

Insert Figures 1, 2, 3, 4, 5, & 6 about here

The results replicate Conway and Brackbill (1970) who tested infants at two and five days of age using the vision test on the Graham Scale. We did not replicate their habituation findings but this may be because the habituation items on the Brazelton Scale are done in a sleep state and the trials to extinction using in an orientation item by Brackbill and Conway appear to have been tested in an awake state. Further analyses of these drug groups are in process.

The second cut of the drug data was based upon a classification of each drug used into seven categories with the drugs coded for strength within each category.[5] This drug coding is shown on Table 3. We chose

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Insert Table 3 about here

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four of the eight test days for special analysis: Days 1, 4, 7, and 28. On each of these days we chose one item from each factor that had appeared on those days and used this item as a marker item. Then, the scores on the marker item were correlated with whether or not the mother had received a particular drug taking into account the dosage leve. If a factor was repeated over the days used, then the same marker item for that factor was chosen. Table 4 shows the results of this analysis and lists the significant results by showing that on Day 1, nine different drugs were related to four different marker items and similarly on Day 4. On Day 7, six different items were related for 10 different drugs. On Day 28, five different drugs are related to four different items.

Insert Table 4 about here

Our one month data provide an important replication to Conway and Brackbill (1970) who found that at one month general anesthesia produced poorer habituation and lower scores on the Bayley Motor Scale. It is interesting to note that the specific general anesthetics mentioned by Conway and Brackbill are the same ones implicated in our data. In addition, Innovar, a narcotic mixed with a tranquilizer is also implicated with especial effects on tremulousness, an item that stood alone as a factor at one month. While one might argue that the drug effects over the first 10 days are transitory, the lasting effects over one month on responsivity or orientation items in our sample has implications for the nature of the interaction between the infant and his or her caretaker. When one considers some of the items that are correlated with these marker items the constellation of behavior produces a coherent pattern of affecting such interactions. For instance longer responding to the pinprick is negatively correlated with cuddliness and positively correlated with startle and lability of skin color. Thus, infants whose mothers had some of the general anesthetics in our sample, at one month of age, responded less to auditory and visual stimuli, shut down more slowly to an aversive stimulus, were less cuddly, had more startles, and were more changing in skin color. Those infants whose mothers received Innovar were more tremulous and showed slower habituation to the bell, rattle, and light - another replication of Conway and Brackbill's slower extinction to orientation at one month. And now, at one month the replication is from the sleep state in which these items are measured by the Brazelton and the awake state of the Graham orientation test.

These results are preliminary and are concerned with single drugs related to the marker items. More complex analyses of the drug groups may qualify these findings. Nevertheloss, some of the responses that appear to have been affected, such as habituation and orientation are central behaviors in learning and in interacting with caretakers.

Uruguayan and Kansas Data

Ninety-two infants were tested at three different hospitals in Montivedeo, Uruguay. Jennifer Ashton who had been trained and who had worked with us in Lawrence, Kansas spent a year in Montivedeo where she in turn trained several other testers. Interestingly enough, after a year's absence, when she returned to Lawrence we checked her for reliability with the other members of the Infant Lab Staff and in all cases her reliability was at .90 or above, giving us confidence that a year of testing away from the training site did not produce idiosyncratic patterns of scoring. Working with these data has been difficult because the drugs had different names and the dosages were recorded in ampules. We have been able to decipher the drug names but the ampule translation to milligrams has eluded us in frustrating - and in our light moments - comic ways. Of the 92 infants, 62 had no drugs recorded on their mother's charts. Most of these came from the two public hospitals as opposed to the private British hospital and therefore are confounded by socio-economic status. The Uruguayan infants were each tested once, most of them at the age of three days. So far we have only been able to make a "guess-work" division into our five drug groups and until we can get definite information on the ampule dosages we cannot make our analyses.[6] However, looking at the means relative to the Kansas sample suggests some interesting differences particularly with respect to the orientation or responsivity items. In the Kansas sample these items are highly intercorrelated with the items all loading onto one major factor every test day. In the Uruguayan sample there is an interesting dichotomy: Orientation to the inanimate stimuli, a bell and a moving object such as a ball fell within the range of the means obtained in Kansas as shown on Figures 7 and 8. But on the items of orientation to animate stimuli - the face and voice and the face and voice together the Uruguayan infants, at three days of age, score way above the Kansas infants, hardly overlapping the distribution of means for the drug groups. These results are shown in Figures 9, 10, 11, and 12.

Insert Figures 7 and 8 about here

Insert Figures 9, 10, 11, 12 about here

A similar picture emerges on the items of general tonus, motor maturity, pull to sit, and consolability (as shown in Figures 13, 14, 15, and 16) -all the means for the five drug groups are higher than the distribution of means for the Kansas sample. On habituation Uruguayan infants

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Insert Figures 13, 14, 15, 16 about here
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were generally lower. In general, our preliminary classification of the drug groups on the Uruguayan infants does not show the drug groups ordered in the same way as the Kansas drug groups but this must remain a tentative statement pending harder information from Uruguay.

Conclusions

In conclusion, it would appear that our analysis permit some tentative statements. Repeated testing of infants with the Brazelton Naonatal Scale reveals a high level of item intercorrelation and a certain similarity of factors over the period of time presented in the eight assessments used in this study. The level of density of significant correlations of items suggests major redundancy in the test. It is, of course, an empirical question as to whether or not a shortened version of the test would produce the same results as the present Scale. It is possible that the stability of the test results requires the repeated assessment of the infant for similar behaviors in a variety of ways and that it is its very redundancy that yields the high reliability in scoring and its basic factor stability. There is also a potential use of the Scale based upon the redundancy and the intercorrelations of the data that may have interesting population difference indicators and individual difference indicators of diagnostic import. There is a hint of this in the comparison of the Kansas and Uruguayan data on the orientation items. Kansas infants showed extensive similarity across all the orientation items, both animate and inanimate. The Uruguayan infants were disparate on the two dimensions: they were much more responsive to the animate than to the inanimate stimuli. To the extent that different cultures respond to and shape on early infant behavioral strengths, to that extent cultural chracteristics and differences may be related to the complexity of such organismic-environmental interactions similar to that suggested by Freedman and Freedman (1969) in their comparisons of consolability among Chinese-American and European American neonates.

At the individual diagnostic level there is also an interesting possibility. If an individual infant shows discrepancy in scoring on items that within the general population are highly correlated a misalignment of response integration could be identified and may turn out to be at the base of a lot of what is being called learning disability - especially where one channel of information processing that is typically related to another is widely divergent within a particular infant.

Finally, the drug related data replicate in important ways findings reported by others. Some may be transitory but some effects persist at least until one month of age and have important implications of parent-child interaction patterns. We need to do more analyses on our data and we also need to have better control of our sample. We hope to accomplish this in the next year.

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FOOTNOTES

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4. Dr. Lila Faye Coyne, of the Menninger Foundation, Topeka, Kansas, served as our major statistical consultant and most of the analyses reported here derived from her invaluable advice and help.

5. Dr. Dov Aleksandorwicz of the Menninger Foundation has lent his pharmacological expertise to this study and it is a pleasure to acknowledge the role he has played in this research.

6. For a translation of drug names from the Spanish to the English equivalents we are very grateful for the consultation of Dr. Sigfried Lindenbaum of the Department of Pharmacy at the University of Kansas and his colleagues who unselfishly offered the aid in the deciphering process.

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FOOTNOTES (cont'd)

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Table 1

Horowitz, Aleksandrowicsz, Ashton, Tims, McCluskey, Culp, and Gallas
1973 SRCD Paper

Items	Day 1		Day 2		Day 3	
	Means	Standard Deviation	Means	Standard Deviation	Means	Standard Deviation
1. Habit light	7.67	2.22	7.08	2.79	7.42	2.21
2. Habit rattle	7.05	2.23	7.58	2.15	7.60	2.03
3. Habit bell	7.98	2.09	7.67	2.35	7.78	1.76
4. Pinprick	5.07	2.22	4.26	1.96	4.82	2.13
5. Orient Inan vis.	4.07	2.69	4.55	2.42	4.51	2.57
6. Orient Inan aud.	4.58	2.06	4.49	1.80	4.44	1.95
7. Orient an. vis.	5.23	2.49	5.19	2.14	5.33	2.50
8. Orient an. aud.	5.51	1.68	5.33	1.43	5.32	1.84
9. Orientan. vis & aud.	5.28	2.32	5.39	2.16	5.64	2.49
10. Alert.	4.10	2.04	4.23	2.11	4.57	2.41
11. Gen. Ton.	4.58	1.23	4.83	0.90	4.82	1.17
12. Mot. Mat.	3.98	1.27	3.67	1.10	3.76	1.57
13. Pull sit	4.17	1.81	4.01	1.65	4.73	1.94
14. Cuddle	5.19	1.46	4.66	1.40	5.00	1.60
15. Def mov.	4.49	2.45	5.05	2.32	6.05	2.18
16. Consol.	7.07	2.58	6.41	2.42	5.57	2.72
17. Peak excite	5.78	1.36	5.94	1.70	6.35	1.56
18. Rapid bldup	4.48	1.80	5.28	1.58	4.49	1.52
19. Irrit.	3.49	1.72	4.60	1.70	4.26	1.76
20. Activ.	4.01	1.34	4.26	1.41	4.51	1.68
21. Tremul.	3.39	2.35	4.07	2.32	4.01	2.17
22. Startle	2.94	1.60	3.32	1.67	3.26	1.56
23. Lab. skin col.	5.19	1.84	4.91	1.89	4.49	1.95
24. Lab. state	4.32	2.23	5.16	2.10	4.51	1.76
25. Self quiet	5.60	3.19	4.85	2.81	4.83	2.61
26. Hand-mouth	4.42	2.64	4.24	2.58	4.89	2.08
27. Smiles	0.57	0.85	0.49	0.85	0.48	0.81

(cont.)

Table 1 (cont.) Horowitz, etc.
1973 SRCD Paper

Items	Day 4		Day 5		Day 7	
	Means	Standard Deviation	Means	Standard Deviation	Means	Standard Deviation
1. Habit light	7.49	2.40	8.00	2.19	7.41	2.53
2. Habit rattle	7.58	2.20	7.95	2.01	7.59	2.37
3. Habit bell	7.85	2.13	8.02	2.03	7.61	2.54
4. Pinprick	5.00	2.49	5.93	2.93	4.91	2.46
5. Orient Inan vis.	3.76	2.52	4.86	2.55	5.02	2.20
6. Orient Inan aud.	4.48	2.09	4.48	2.24	5.00	1.78
7. Orient an. vis.	5.42	2.38	5.89	2.34	5.84	2.07
8. Orient an. aud.	5.57	1.76	5.39	1.35	5.82	1.53
9. Orientan. vis & aud.	5.42	2.27	5.70	2.39	5.95	2.21
10. Alert.	4.39	2.10	4.57	1.89	5.32	2.22
11. Gen. Ton.	4.98	1.05	4.98	1.17	4.82	1.15
12. Mot. Mat.	3.89	1.77	4.34	1.67	4.32	1.34
13. Pull sit	4.41	1.86	3.98	1.97	4.84	1.89
14. Cuddle	5.26	1.21	4.80	1.62	4.91	1.70
15. Def mov.	6.17	1.77	5.66	2.67	5.57	2.42
16. Consol.	5.74	2.39	5.75	2.53	5.73	2.53
17. Peak excite	6.05	1.63	6.04	1.85	5.84	1.57
18. Rapid bldup	4.51	1.58	4.34	2.05	3.77	1.93
19. Irrit.	4.24	1.76	3.80	1.96	3.39	1.66
20. Activ.	4.98	1.36	4.84	1.46	4.70	1.42
21. Tremul.	3.49	2.14	2.84	2.03	3.07	2.08
22. Startle	3.23	1.69	2.68	1.51	2.64	1.24
23. Lab. skin col.	4.98	1.61	4.50	1.98	4.49	1.74
24. Lab. state	4.78	2.04	4.68	2.23	4.32	2.07
25. Self quiet	5.32	2.58	4.86	2.88	5.70	2.89
26. Hand-mouth	4.91	2.58	4.57	2.59	3.86	2.30
27. Smiles	0.92	1.68	0.70	1.23	1.09	1.80

Table 1 (cont.) Horowitz, etc.
1973 SRCD Paper

Items	Day 10		Day 28	
	Means	Standard Deviation	Means	Standard Deviation
1. Habit light	8.11	2.35	8.86	1.76
2. Habit rattle	8.05	2.24	8.84	2.05
3. Habit bell	7.98	2.43	9.00	1.89
4. Pinprick	6.09	2.44	5.61	2.96
5. Orient Inan vis.	5.25	2.11	6.34	2.28
6. Orient Inan aud.	5.07	1.55	5.61	1.94
7. Orient an. vis.	6.14	2.14	7.27	1.82
8. Orient an. aud.	5.57	1.61	6.25	2.15
9. Orientan. vis & aud.	6.23	1.90	7.20	1.95
10. Alert.	5.57	2.41	6.43	2.13
11. Gen. Ton.	4.80	1.11	5.41	1.30
12. Mot. Mat.	4.09	1.51	5.48	1.76
13. Pull sit	4.55	1.74	5.59	2.37
14. Cuddle	4.77	1.51	4.73	1.95
15. Def mov.	6.34	2.40	6.59	2.24
16. Consol.	6.43	2.97	5.56	3.30
17. Peak excite	5.59	1.94	5.93	2.24
18. Rapid bldup	4.16	2.37	4.43	2.49
19. Irrit.	3.30	2.14	3.00	2.06
20. Activ.	4.57	1.26	5.25	1.53
21. Tremul.	2.89	2.01	2.55	1.86
22. Startle	2.50	1.15	2.18	1.02
23. Lab. skin col.	4.43	1.69	4.57	1.56
24. Lab. state	4.09	2.36	4.55	2.67
25. Self quiet	5.57	3.19	4.77	3.45
26. Hand-mouth	3.59	2.23	2.82	2.66
27. Smiles	1.00	1.56	1.23	1.40

Horowitz, Aleksandrowicz, Ashton, Tims, McCluskey, Culp and Gallas

SRCD, 1973

Table 2 A

STEMS	ITEMS	FACTORS I.	II	III	IV	V	VI	VII	VIII	IX	X	h^2
Habit. light	1							-.81				.79
Habit. rattle	2				-.87							.87
Habit. bell	3				-.85							.79
Pinprick	4									-.57		.72
Orient. inan. vis.	5	.76										.83
Orient. inan. aud.	6	.68										.80
Orient. an. vis.	7	.89										.89
Orient. an. aud.	8	.65										.80
Orient. an. vis. & aud.	9	.85										.86
Alert	10	.77										.75
Gen. Ton.	11			.80								.79
Mot. Mat.	12					-.87						.86
Pull Sit	13			.77								.72
Cuddle	14						.88					.88
Def. mov.	15				.48							.61
Consol	16							54				.70
Peak excite	17		.74								.42	.85
Rapid bldup	18		.58						-.46			81
Irrit.	19		.88									.83
Activ.	20			.54								.68
Tremul.	21									.60		.60

Startle	22									.77		.69
Lab. skin col.	23						-.50			.50		.72
Lab. state	24		.86									.82
Self quiet	25					-.50	-.45					.82
Hand-mouth	26										-.84	.79
Smiles	27								-.84			.77

Horowitz, Aleksandrowicz, Ashton, Tims, McCluskey, Culp and Gallas

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Table 2 B

STEMS	ITEMS	FACTORS I	II	III	IV	V	VI	VII	VIII	IX	h^2
Habit. light	1				-.53						.62
Habit. rattle	2				-.89						.84
Habit. bell	3				-.90						.85
Pinprick	4							-.83			.75
Orient. inan. vis.	5	-.83									.86
Orient. inan. aud.	6	-.83									.72
Orient. an. vis.	7	-.90									.85
Orient. an. aud.	8	-.50				.44					.64
Orient. an. vis. & aud.	9	-.93									.90
Alert	10	-.75									.82
Gen. Ton.	11								-.80		.74
Mot. mat.	12			.57							.74
Pull sit	13			.76							.65
Cuddle	14						.83				.77
Def. mov.	15									-.40	.48
Consol	16			.40							.74
Peak excite	17		-.71								.72
Rapid bldup	18							-.76			.71
Irrit.	19		-.70								.80
Activ.	20								-.75		.66
Tremul.	21			-.57							.74
Startle	22						.49			.53	.78
Lab. skin col.	23									.87	.82
Lab. state	24		-.90								.84
Self-quiet	25					-.53					.45
Hand-mouth	26					-.79					.79
	27					[illegible]					[illegible]

Horowitz, Aleksandrowicz, Ashton, Tims, McCluskey, Culp and Gallas

SRCD, 1973 Table 2 C

STEMS	ITEMS	FACTORS I	II	III	IV	V	VI	VII	VIII	h^2
Habit. light	1			-.68						.84
Habit. rattle	2			-.86						.80
Habit. bell	3			-.83						.75
Pinprick	4			-.42						.45
Orient. inan. vis.	5	.89								.87
Orient. inan. aud.	6	.64								.64
Orient. an. vis.	7	.92								.91
Orient. an. aud.	8	.68								.74
Orient. an. vis. & aud.	9	.89								.86
Alert	10	.73								.83
Gen. Ton.	11							-.60		.60
Mot. mat.	12	.40			-.52					.62
Pull sit	13			.43						.68
Cuddle	14							-.87		.88
Def. mov.	15	.47						.48		.76
Consol	16		.68						-.48	.79
Peak excite	17		-.82							.80
Rapid bldup	18		-.79							.77
Irrit.	19		-.85							.81
Activ.	20		-.55					-.50		.70
Tremul.	21				.70					.60
Startle	22				.74					.67
Lab. skin col.	23						-.77			.70
Lab. state	24		-.72							.74
Self-quiet	25					-.66				.63
Hand-mouth	26					-.80				.80
Smiles	27			.46					-.68	.82

Horowitz, Aleksandrowicz, Ashton, Tims, McCluskey, Culp and Gallas

SRCD, 1973

Table 2D

STEMS	ITEMS	FACTORS I	II	III	IV	V	VI	VII	VIII	IX	h^2
Habit. light	1				-.67						.72
Habit. rattle	2				-.84						.82
Habit. bell	3				-.72						.83
Pinprick	4									.68	.70
Orient. inan. vis.	5	.84									.86
Orient. inan. aud.	6	.65								-.45	.73
Orient. an. vis.	7	.85									.87
Orient. an. aud.	8	.77									.76
Orient. an. vis. & aud.	9	.80									.74
Alert	10	.78									.84
Gen. Ton.	11	.41						-.54			.65
Mot. mat.	12			.81							.84
Pull sit	13							-.44	.43		.77
Cuddle	14						.76				.66
Def. mov.	15							-.71			.59
Consol	16		-.45			.49					.66
Peak excite	17	-.49									.73
Rapid bldup.	18		.78								.72
Irrit.	19		.86								.85
Activ.	20						.53				.73

Tremul.	21							.75		.82
Startle	22							.72		.76
Lab. skin col.	23				-.81					.74
Lab. state	24	.54	-.62							.83
Self-quiet	25			.60			-.43			.75
Hand-mouth	26		.64			.44				.86
Smiles	27	-.65								.73

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SRCD, 1973

Table 2 E

STEMS	ITEMS	FACTORS I	II	III	IV	V	VI	VII	VIII	h^2
Habit. light	1			.72			.49			.78
Habit. rattle	2			.94						.92
Habit. bell	3			.90						.87
Pinprick	4					.51				.69
Orient. inan. vis.	5	.64								.78
Orient. inan. aud.	6	.82								.80
Orient. an. vis.	7	.89								.86
Orient an. aud.	8	.75								.81
Orient. an. vis. & aud.	9	.90								.87
Alert	10	.72								.70
Gen. Ton.	11				.70					.69
Mot. mat.	12				.82					.81
Pull sit	13				.63					.69
Cuddle	14				.62		-.42			.68
Def. mov.	15	.41				-.67				.72
Consol	16		.75							.67
Peak excite	17		.83							.80
Rapid bldup	18		.66							.59
Irrit.	19		.59			-.66				.82
Activ.	20				.47	-.63				.78
Tremul.	21								.84	.82

Startle	22							.82		.80
Lab. skin col.	23						-.41	.69		.77
Lab. state	24		.89			-.45				.86
Self-quiet	25						-.75			.75
Hand-mouth	26								-.54	.74
Smiles	27						-.80			.77

Horowitz, Aleksandrowicz, Ashton, Tims, McCluskey, Culp and Gallas

SRCD, 1973

Table 2 F

STEMS	ITEMS	FACTORS								
		I	II	III	IV	V	VI	VII	VIII	h^2
Habit. light	1			.82						.81
Habit. rattle	2			.89						.86
Habit. bell	3			.83						.81
Pinprick	4								.70	.76
Orient. inan. vis.	5	-.84								.82
Orient. inan. aud.	6						-.41			.65
Orient. an. vis.	7	-.88								.80
Orient. an. aud.	8	-.68								.76
Orient. an. vis. & aud.	9	-.87								.81
Alert	10	-.82								.79
Gen. Ton.	11	-.46	-.42							.75
Mot. mat.	12								-.74	.76
Pull sit	13					-.56				.61
Cuddle	14				.79					.81
Def. mov.	15							.83		.77
Consol	16		.73							.80
Peak excite	17		-.86							.85
Rapid bldup	18		-.79							.82
Irrit.	19		-.78							.85
Activ.	20	-.55								.65
Tremul.	21						-.84			.78

Startle	22						-.61			.69
Lab. skin col.	23		-.53						-.54	.80
Lab state	24		-.80							.76
Self-quiet	25					.60				.68
Hand-mouth	26	-.63			-.50					.83
Smiles	27				.43	.72				.86

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Table 2 G

STEM	ITEMS	FACTORS I	II	III	IV	V	VI	VII	VIII	h^2
Habit. light	1			.93						.91
Habit. rattle	2			.89						.84
Habit. bell	3			.83						.79
Pinprick	4			.44	-.68					.72
Orient. inan. vis.	5	-.88								.86
Orient. inan. aud.	6	-.75								.61
Orient an. vis.	7	-.60								.82
Orient. an. aud.	8	-.71								.81
Orient. an. vis. & aud.	9	-.72								.92
Alert	10	-.61								.78
Gen. Ton.	11					.74				.66
Mot. mat.	12	-.41				.47		-.44		.83
Pull sit	13					.50	.45			.67
Cuddle	14	-.47				.40			.51	.80
Def. mov.	15	-.77								.80
Consol	16		-.84							.77
Peak excite	17		.83							.84
Rapid bldup	18		.84							.80
Irrit.	19		.76							.86
Activ.	20					.75				.82
Tremul.	21							.52		.57

Startle	22				.80					.70
Lab. skin col.	23						.77			.74
Lab state	24		.63				.41			.71
Self-quiet	25	-.60							.56	.80
Hand-mouth	26							.79		.79
Smiles	27								.79	.76

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SRCD, 1973

Table 2 H

STEMS	ITEMS	FACTORS I	II	III	IV	V	VI	VII	h^2
Habit. light	1			-.80					.77
Habit. rattle	2			-.94					.91
Habit. bell	3			-.94					.91
Pinprick	4					.70			.77
Orient inan. vis.	5	-.81							.68
Orient. inan. aud.	6	-.68							.67
Orient an. vis.	7	-.82							.85
Orient. an. aud.	8	-.71							.65
Orient. an. vis. & aud.	9	-.87							.86
Alert	10	-.77							.83
Gen. Ton.	11				.43			.49	.65
Mct. mat.	12							.58	.67
Pull sit	13							.78	.68
Cuddle	14					-.64			.64
Def. mov.	15	-.44						.70	.73
Consol	15		-.82						.80
Peak excite	17		.67					.41	.82
Rapid bldup	18		.85						.75
Irrit.	19		.50		.52				.63
Activ.	20							.60	.70

Tremul.	21					.80		.75
Startle	22				-.52			.41
Lab. skin col.	23	.63						.67
Lab. state	24	.85						.80
Self-quiet	25			.49	-.40			.57
Hand-mouth	26			.75				.72
Smiles	27			-.69				.69

TABLE A

MEDICATION GROUPS

Group 0 N=5

No premedication (No depressive or sedative medication)

Group I N=20

One or two of the following:

Nisentil	30 mgm or less
Sparine	25 mgm or less
Demerol	50 mgm of less (8 hours prior to deliver)

Group II N=7

One of two of the following:

Nisentil	30-60 mgm
Sparine	25-50 mgm
Demerol	50-100 mgm (8 hours prior to delivery)
Seconal	90 mg. P.O.

Group III N=4

More than two of above medication in doses of:

Nisentil	60 mgm of more
Sparine	50 mgm or more
Demerol	100 mgm or more (8 hours before delivery)
Seconal	100-180 mgm. P.O.

Group IV N=13

General anesthesia

FIGURE 1

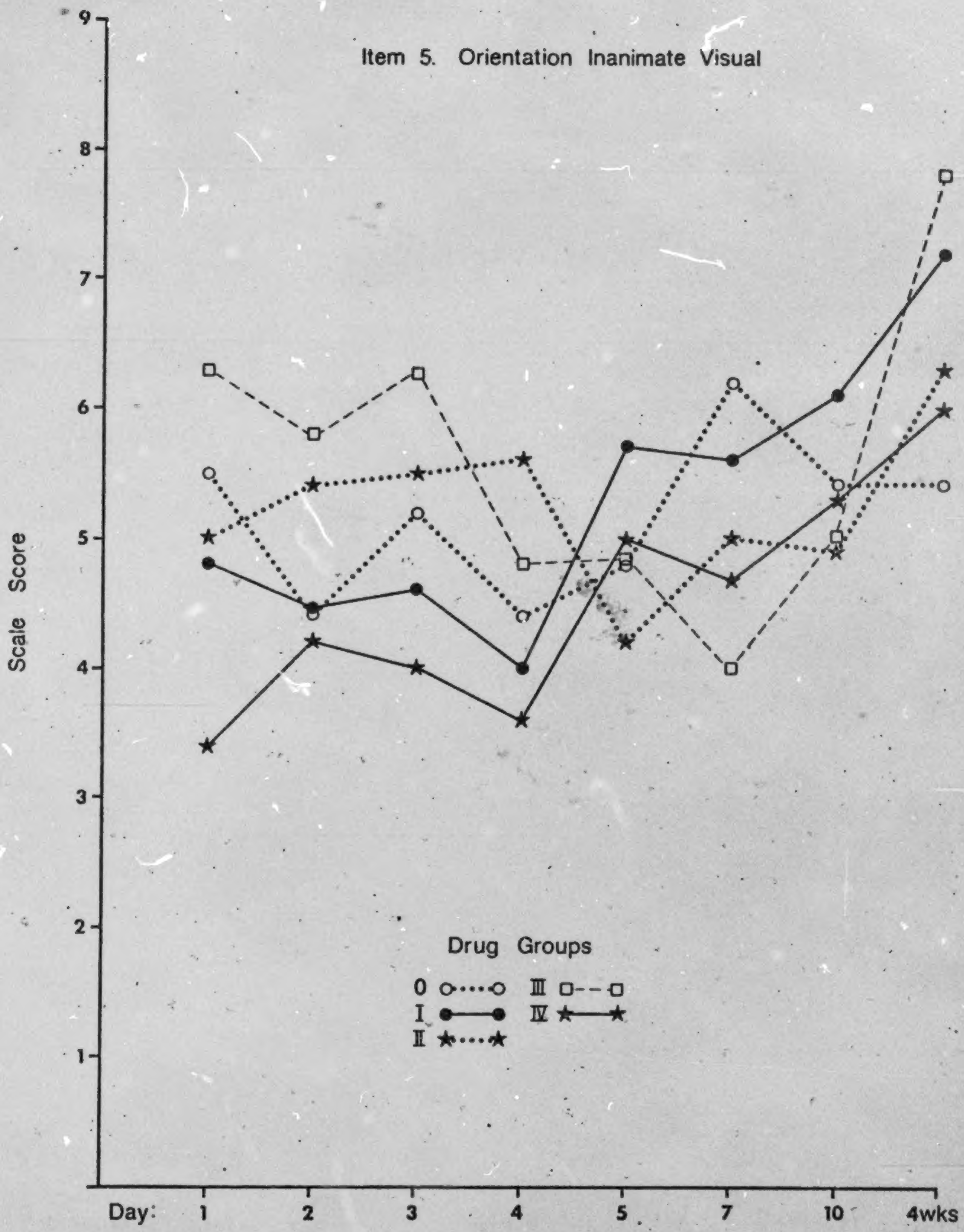
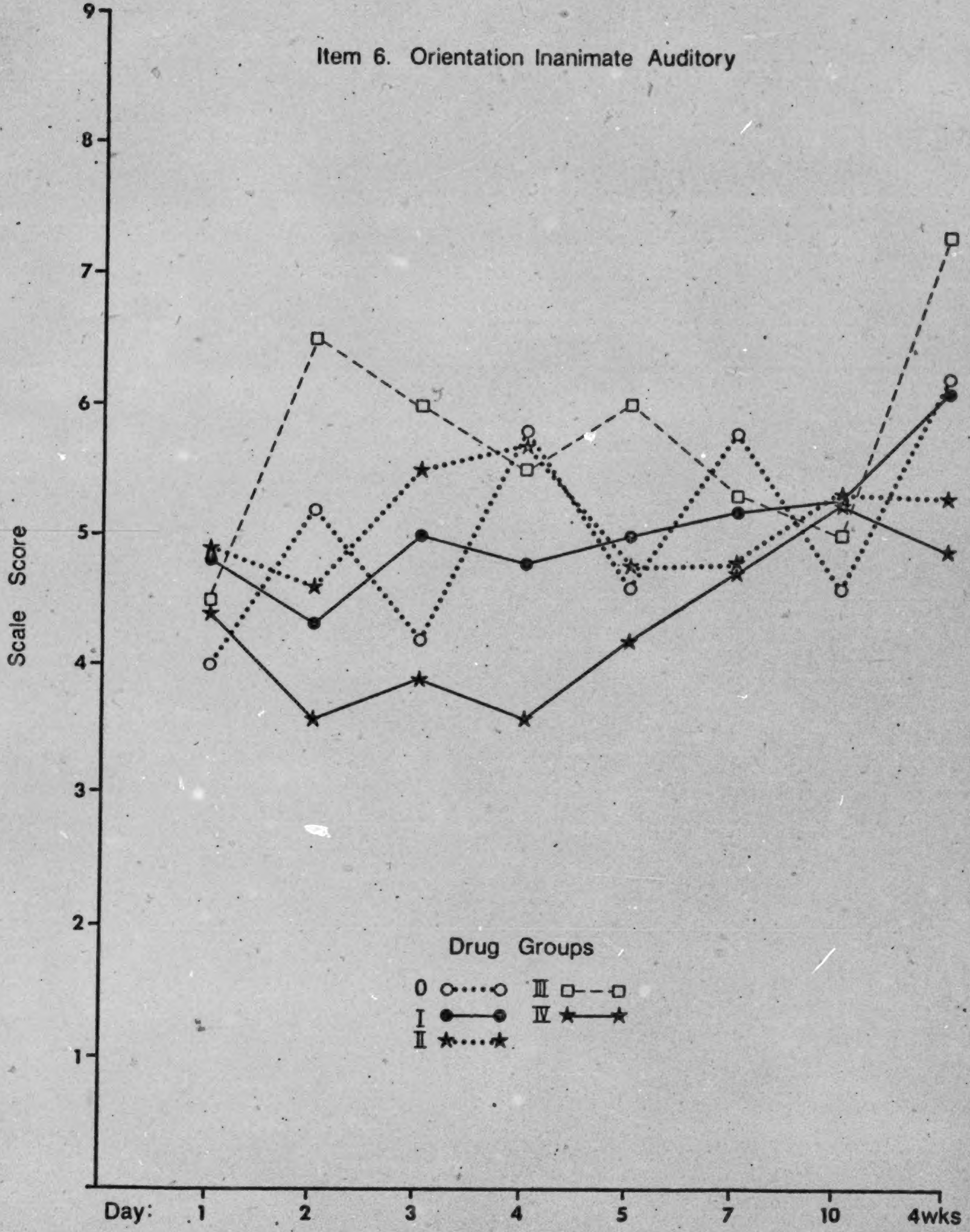

Item 5. Orientation Inanimate Visual
Scale Score
9
8
7
6
5
4
3
2
1
Day: 1 2 3 4 5 7 10 4wks
Drug Groups
0 ○····○
I ●——●
II ★····★
III □- - □
IV ★——★

FIGURE 2



Item 6. Orientation Inanimate Auditory

FIGURE 3

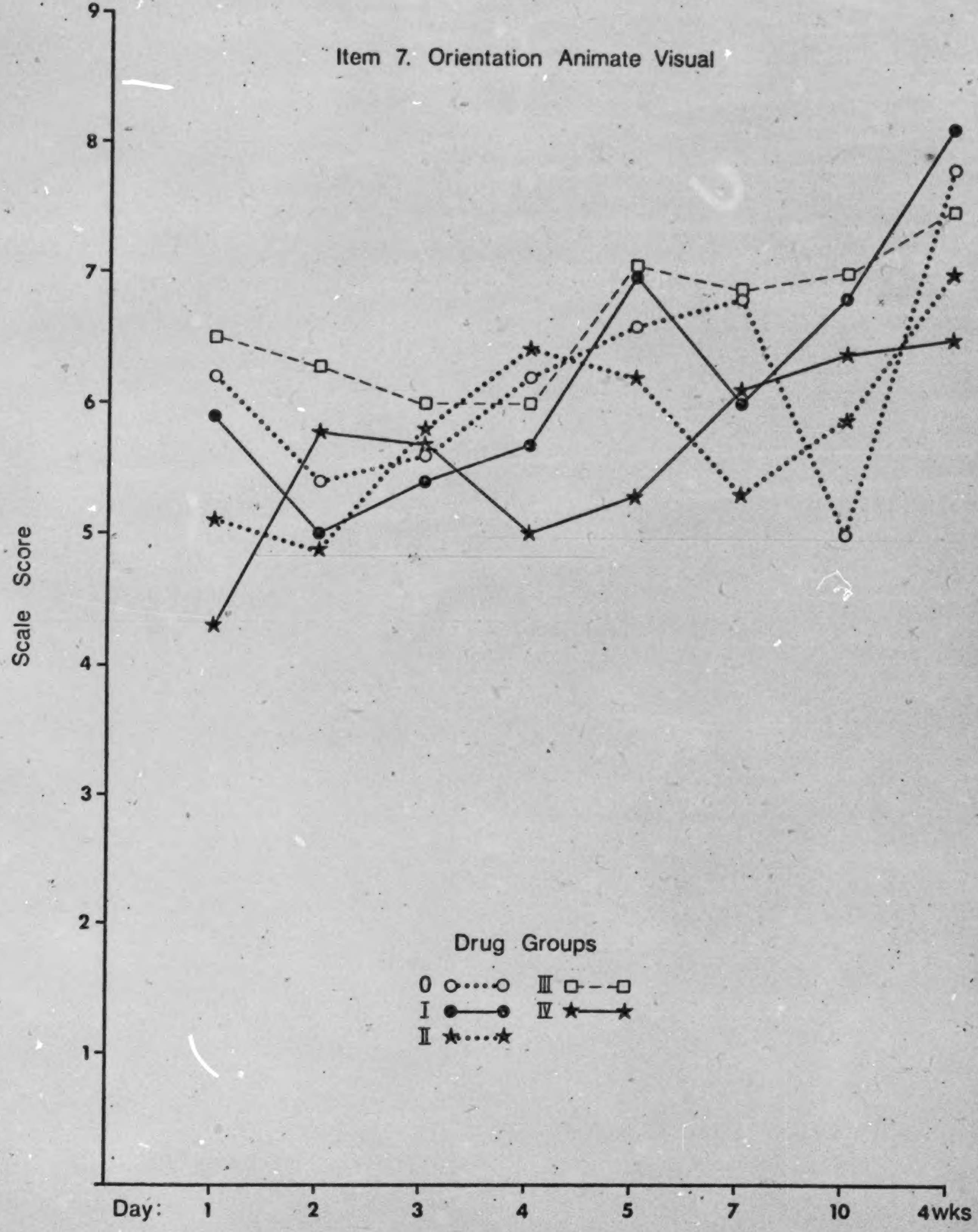
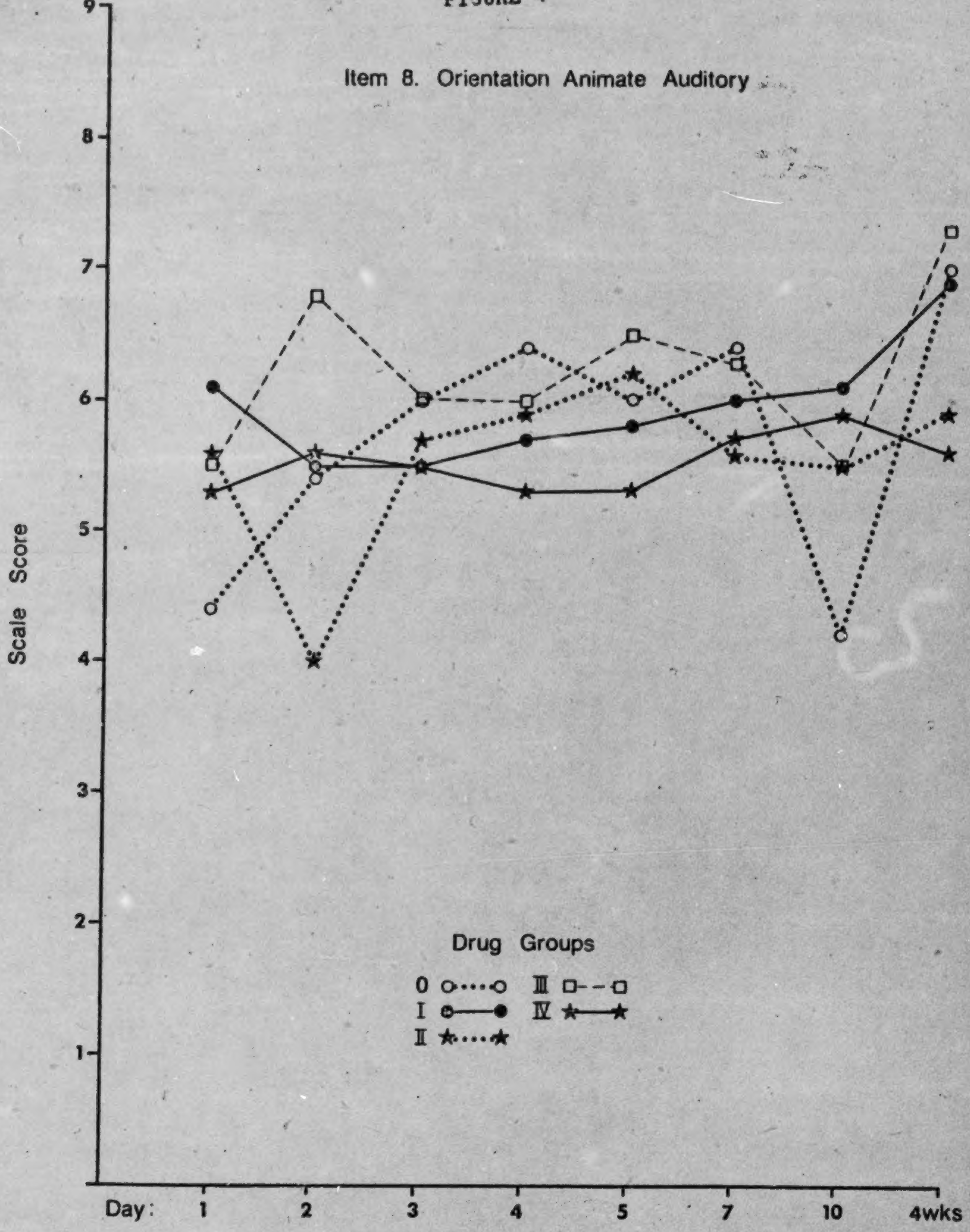

Item 7. Orientation Animate Visual
Scale Score
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 ○·····○
I ●——●
II ★·····★
III □- - -□
IV ★——★

FIGURE 4



Item 8. Orientation Animate Auditory

FIGURE 5

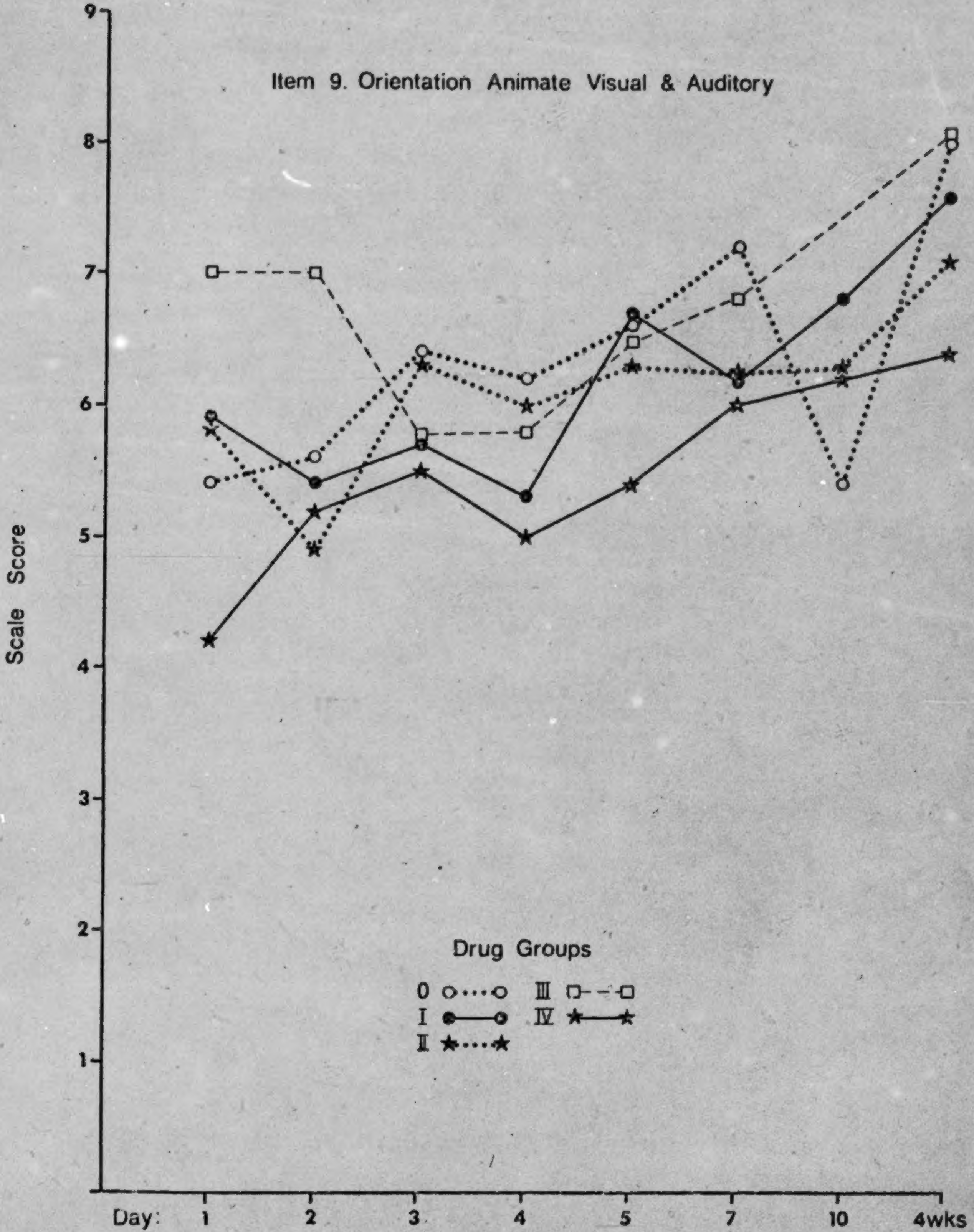

Item 9. Orientation Animate Visual & Auditory
Scale Score
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 ○····○
I ●——○
II ★····★
III □- - -□
IV ★——★

FIGURE 6

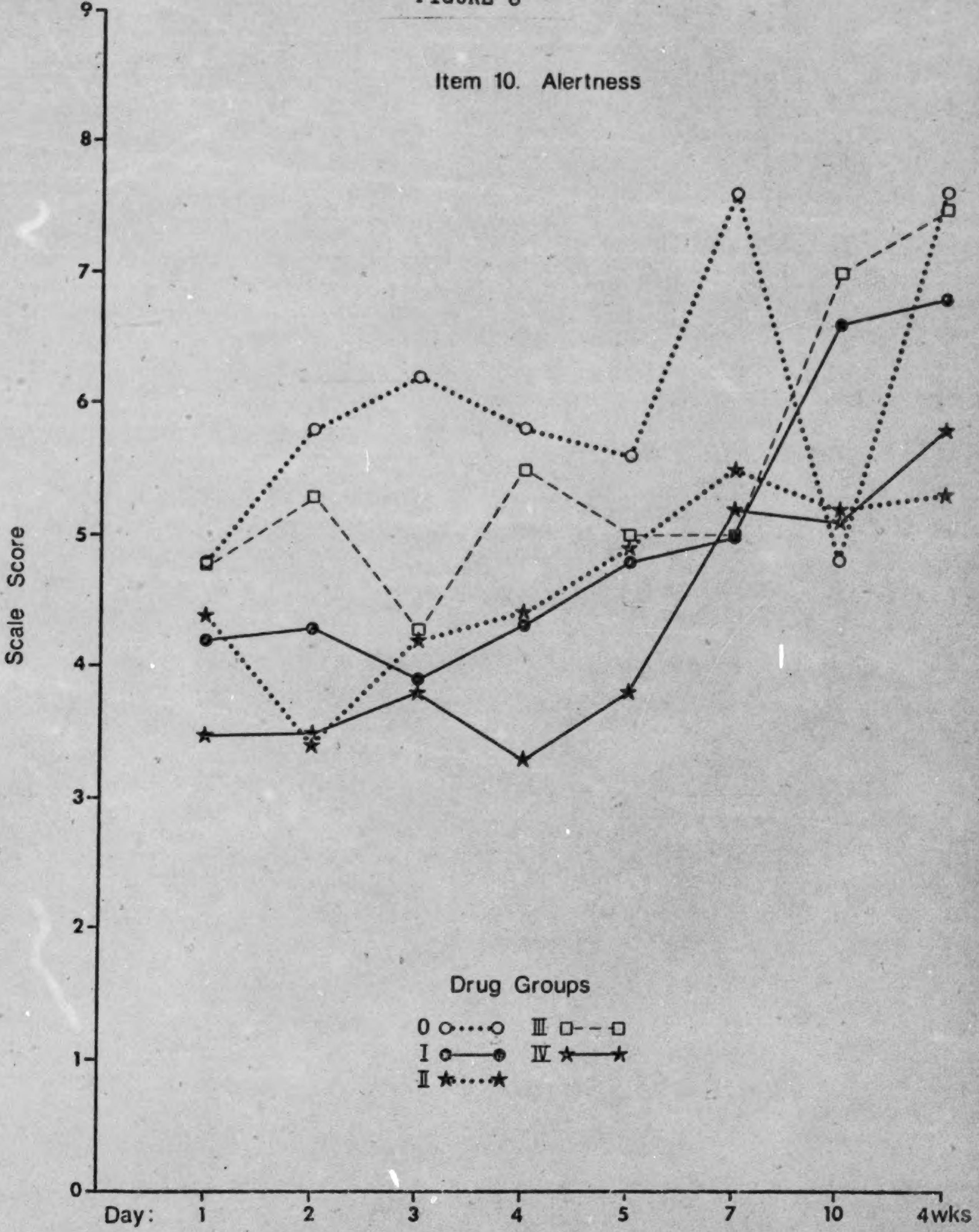

Item 10. Alertness

Table 3

DRUG CODE

1. Local & Regional Anesthetics (classified according to route of administration):

   1.0 unknown or others (i.e., not listed)
   1.1 perineal (local)
   1.2 pudendal or paracervical block)
   1.3 spinal, saddle block, caudal, epidural)- regional

2. Tranquilizers

   2.0 unknown and not listed
   2.1 Chlorpromazine (Thorazine), Base dose: 50 mg.
   2.2 Diazepam (Valium), Base dose: 5 mg.
   2.3 Chlordiazepoxide (Librium), Base dose: 10 mg.
   2.4 Hydroxizine (Atarax), Base dose: 25 mg.
   2.5 Promethazine (Phenergan), Base dose: 25 mg.

3. Narcotic Analgesics

   3.0 not listed or unknown
   3.1 Meperidine (Demerol), Base dose: 50 mg.
   3.2 Alphaprodine (Nisentil), Base dose: 30 mg.
   3.3 Droperidol, Base dose: 5mg. (given only with or in combination with Fentanyl citratem, Base dose: 0.1 mg., as "Innovar"
   3.4 Morphine, Base dose: 10 mg.

4. Barbiturates

   4.0 other or unknown
   4.1 Thipental (Na Penthotal), I.V. (dose not usually recorded)
   4.2 Secobarbital (Seconal), P.O., Base dose, gr. 1/2 (or rectal)

5. Inhalation General Anesthetics

   5.0 other and unknown
   5.1 Nitrous oxide
   5.2 Cyclopropane
   5.3 Methoxyflurane (penthrane)
   5.4 Fluothane (?)

6. Scopolamine (hyoscine), Base dose: 1/2 amp.

7. Muscle Relaxants: Anectine (only one used)

Table 4

DAY	MARKER ITEM		SIGNIFICANTLY CORRELATED WITH		
	#	Name	Code	Name or Type	Correl.
1	9	Orient. to aud & vis stimulus	1.2	Pudenal (local)	.30
			3.2	Nisentil (short acting narcotic)	.30
			5.3	Methoxyflurane (penthrane general anesthetic)	-.30
			6.0	Scopolamine	-.38**
			Σ 1.0	All local anesthetics	.30
	12	Motor Maturity	3.2	Nisentil (short acting narcotic)	.30
	13	Pull to sit	2.5	Promethazine (Phenegran tranquilizing antihistamine)	-.39*
	14	Cuddliness	3.3	Innovar (tranquilizer & narcotic)	-.54**
			4.1	Thiopental-(barbituate)	-.47*
			5.2	Cyclopropane -(general anesthetic)	-.54**
			7.0	Anectine (muscle relaxant)	-.47*
DAY 4	15	Defensive Movements	2.2	Diazepam (Valium - tranaullizer)	-.64**
	18	Rapidity of buildup	1.1	Perineal (local anesthetic)	.36
			5.1	Nitrus Oxide (inhalation general anesthetic)	-.33
	23	Lability of skin color	3.3	Innovar (tranquilizer and narcotic)	.30
			5.2	Cyclopropane (general inhalation anesthetic)	.30
	3	Response decrement to bell	7.0	Anectine (muscle relaxant)	.46*
			2.2	Diazepam (Valium tranquilizer)	-.32

		4.2	Secobarbital (seconal barbituate)	-.44*
		5.4	Fluothane (inhalation general anesthetic)	-.35
		Σ4.0	Barbituates	-.47*
		Σ all	All drugs	-.47*
4	Response decrement to Pinprick	7	Anectine (muscle relaxant)	.35

Table 4 (cont.)

DAY	MARKER ITEM		SIGNIFICANTLY CORRELATED WITH		
	#	Name	Code	Name or type	Correl.
7	9	Orient. to vis. & aud.	3.2	Nisentil (narcotic)	-.39*
			5.2	Cyclopropane (inhalation general anesthetic)	-.39*
	14	Cuddliness	2.4	Atarax (tranquilizer)	-.32
18	18	Rapidity of buildup	1.3	Spinal anesthetic	-.32
			2.5	Promethazine (Phenegran)	-.38
	21	Tremulousness	3.3	Innovar (tranquilizer & narcotic)	.30
			5.2	Cyclopropane (inhalation general anesthetic)	.30
	27	Smiling	1.1	Perineal (local anesthetic)	.40*
			5.1	Nitrous Oxide (inhalation general anesthetic)	-.33
			Σ5.0	General anesthetic as a group	-.31
	4	Response decrement to	2.2	Valium (tranquilizer)	.30
			5.4	Fluothane (inhalation general anesthetic)	.34
DAY 28	9	Orient. to animate aud. & vis.	5.3	Methoxyflurane (Penthrane inhalation general anesthetic)	-.32
			Σ1.0	All local anesthetics	.32
	21	Tremulousness	3.3	Innovar (tranquilizer & narcotic)	.30
			5.2	Cyclopropane (inhalation general anesthetic	.30
	3	Response decrement to bell	3.3	Innovar (tranquilizer & narcotic)	-.39
			5.2	Cyclopropane (inhalation general anesthetic)	-.39

4	Response decrement to Pinprick	5.3	Methoxyflurane (penthrane inhalation general anesthetic)	-.32
		≤1.0	All local anesthetics	.32

---

at .05

* at .01

** at .001

FIGURE 7

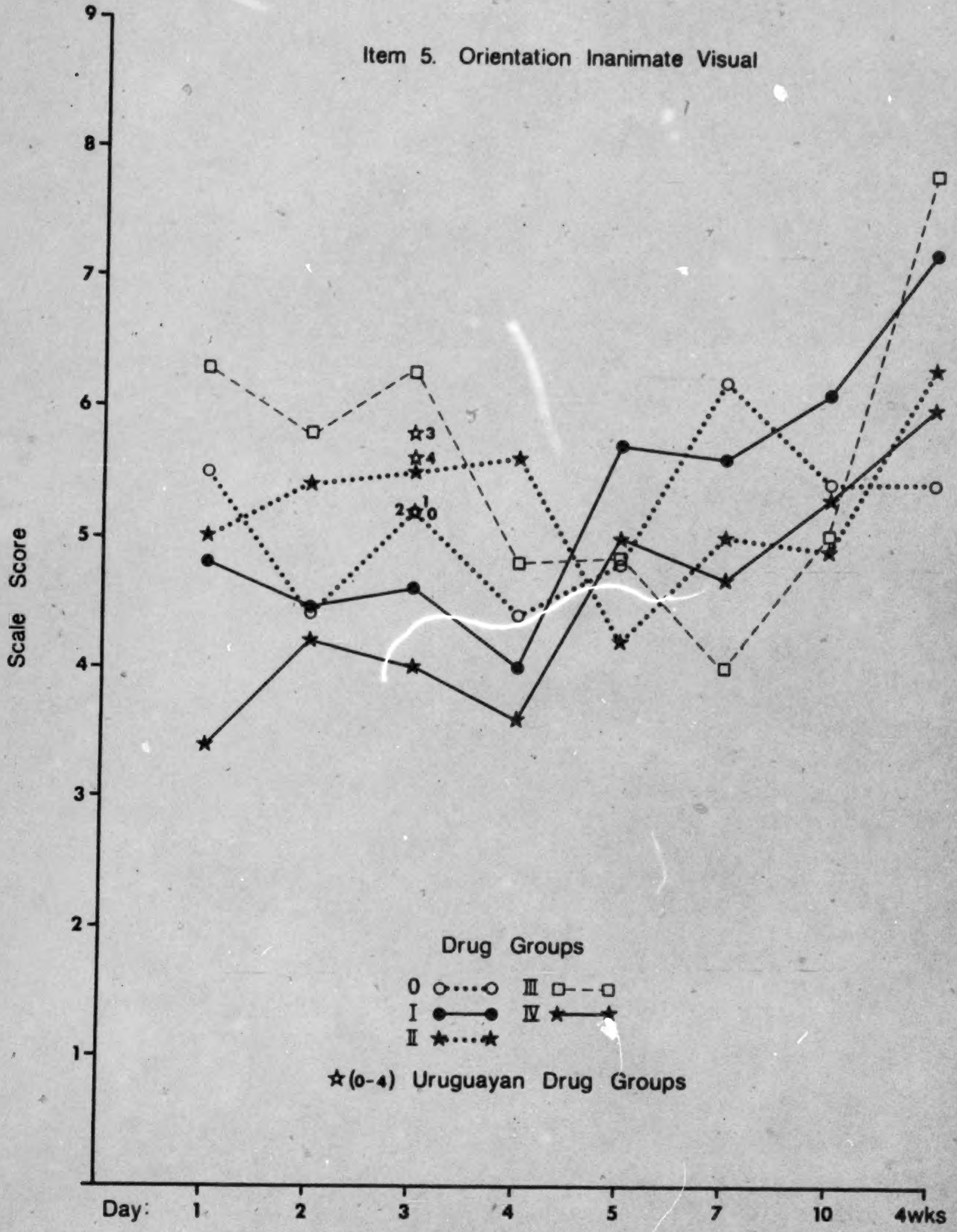
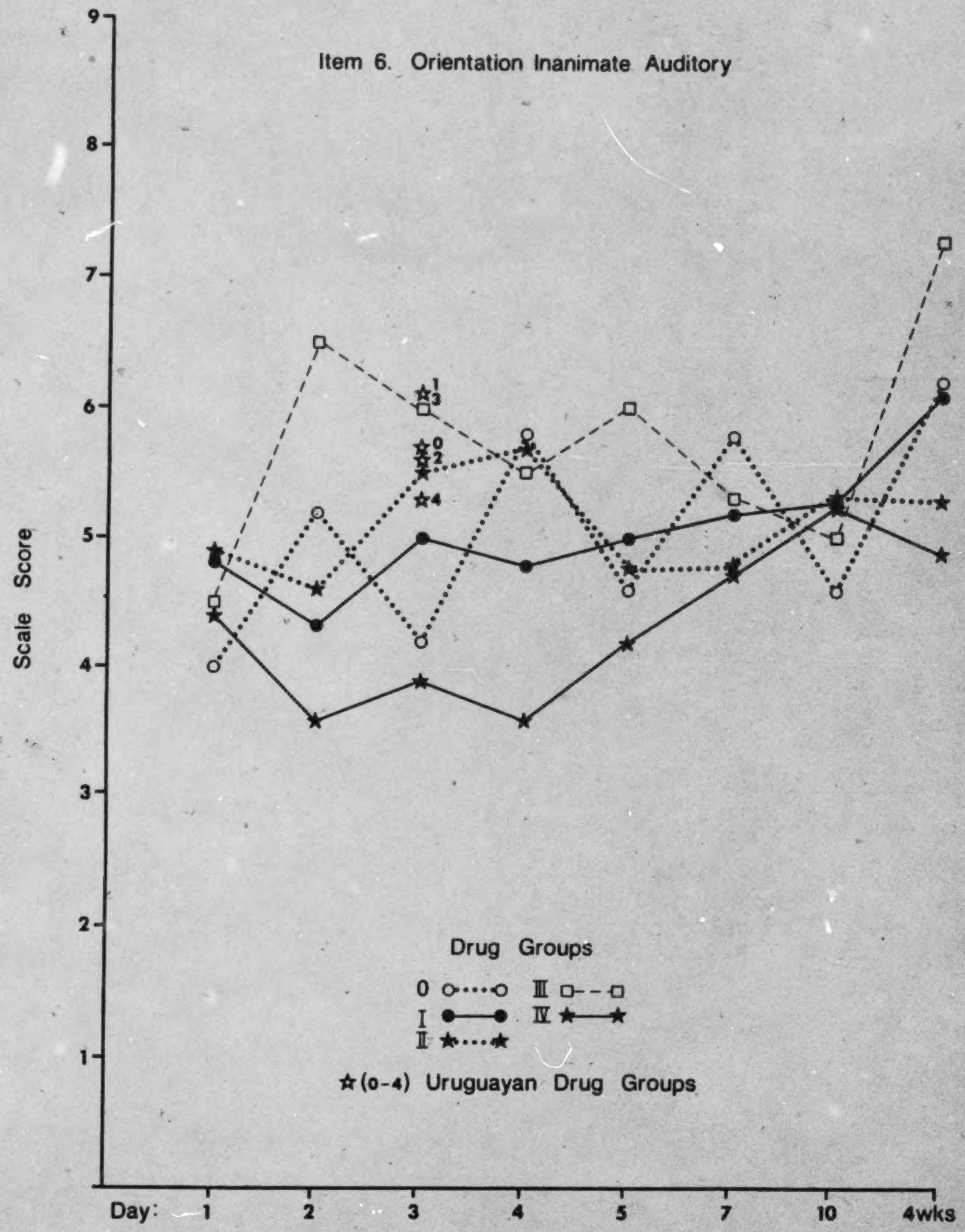

Item 5. Orientation Inanimate Visual
Scale Score
9
8
7
6
5
4
3
2
1
Day: 1 2 3 4 5 7 10 4wks
☆3
☆4
2☆1 0
Drug Groups
0 ○····○
I ●——●
II ★····★
III □– –□
IV ★——★
☆(0-4) Uruguayan Drug Groups

FIGURE 8



Item 6. Orientation Inanimate Auditory
9
8
7
6
5
4
3
2
1
Scale Score
Day: 1
2
3
4
5
7
10
4wks
1
3
0
2
4
Drug Groups
0 ○·····○
I ●——●
II ★·····★
III □– – □
IV ★——★
☆(0-4) Uruguayan Drug Groups

FIGURE 9

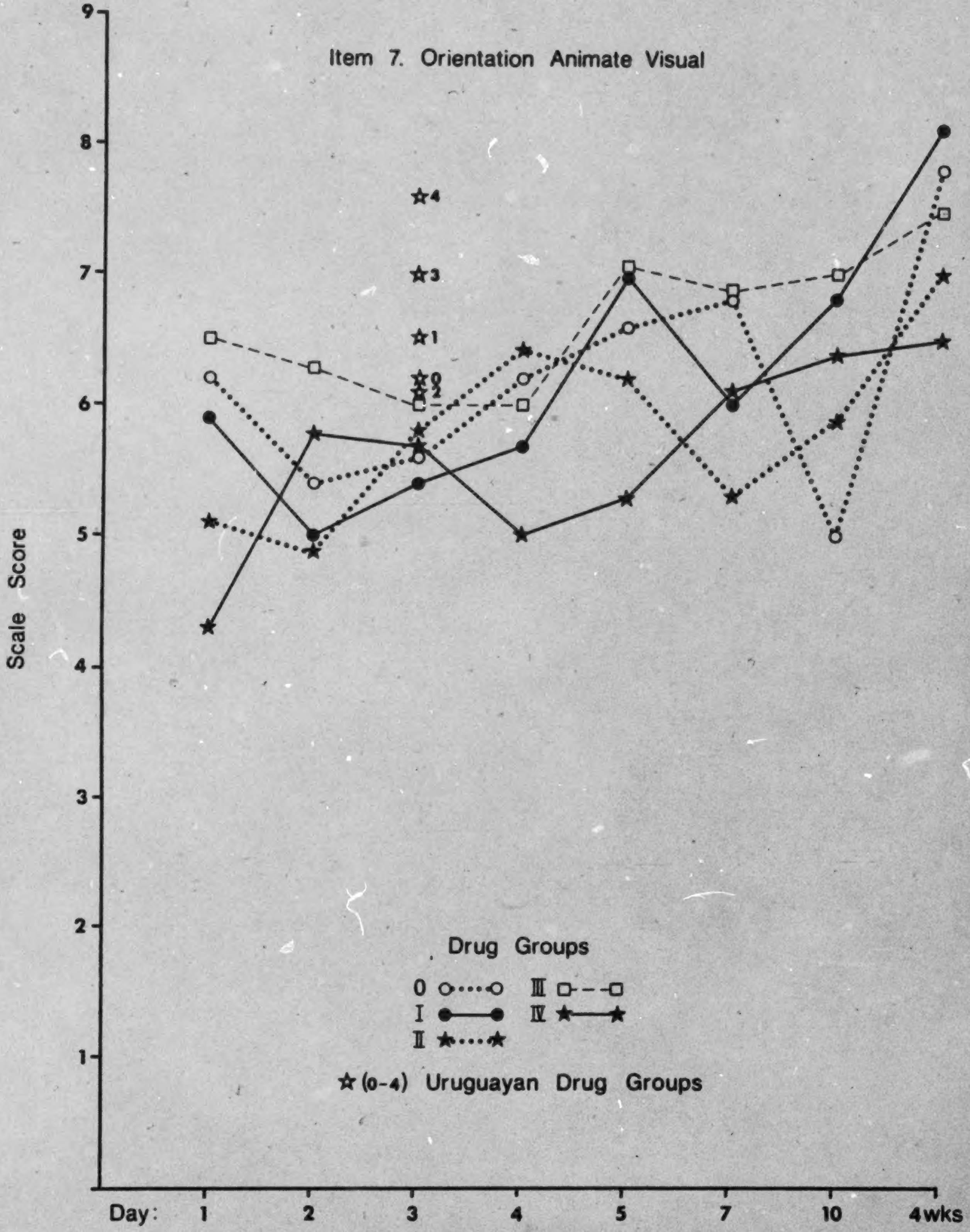

Item 7. Orientation Animate Visual
Scale Score
9
8
7
6
5
4
3
2
1
Day: 1 2 3 4 5 7 10 4wks
☆4
☆3
☆1
☆0
☆2
Drug Groups
0 ○····○
I ●——●
II ★····★
III □- - -□
IV ★——★
☆(0-4) Uruguayan Drug Groups

FIGURE 10

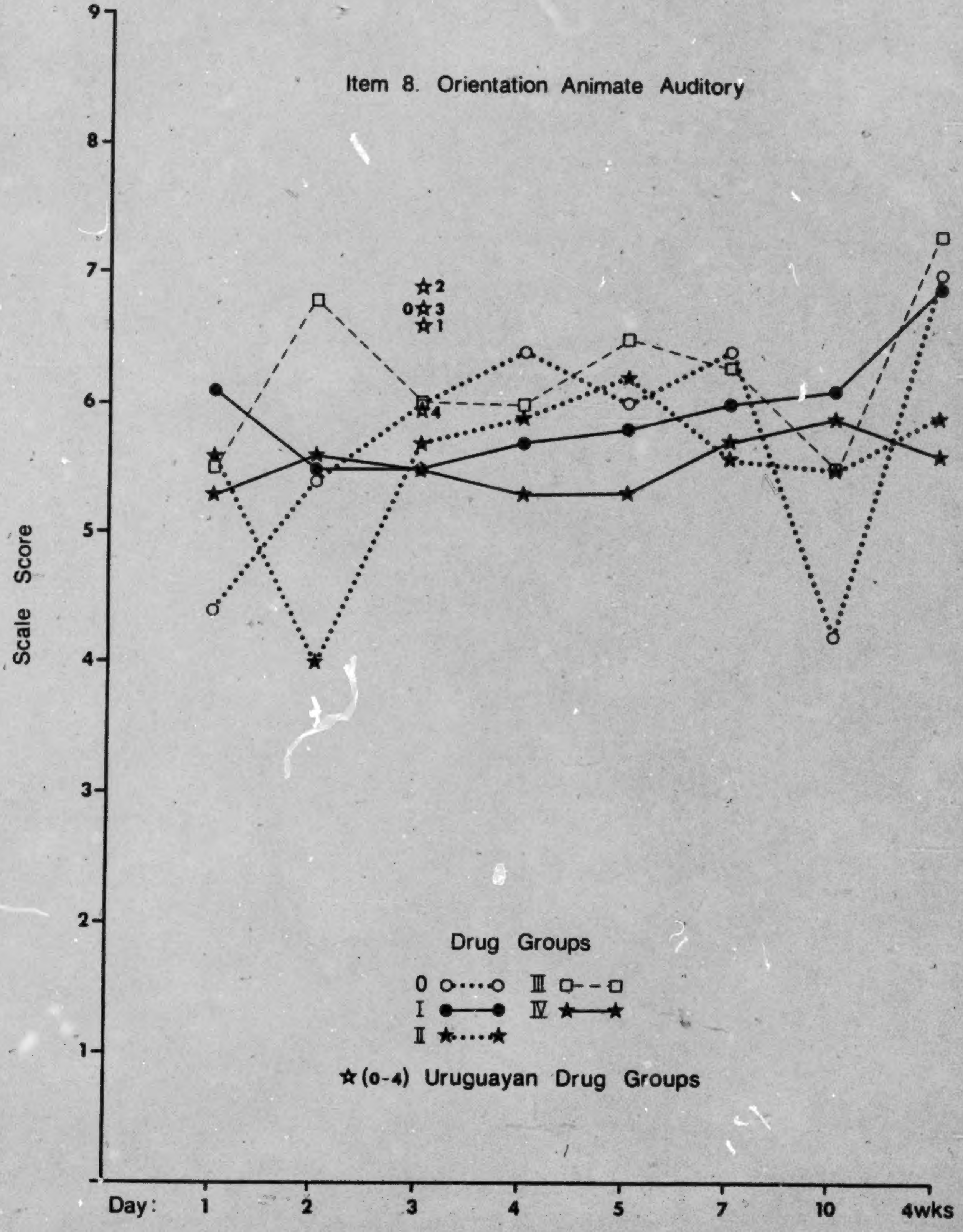

Item 8. Orientation Animate Auditory
Scale Score
9
8
7
6
5
4
3
2
1
Day: 1 2 3 4 5 7 10 4wks
☆2
0☆3
☆1
☆4
Drug Groups
0 ○····○
I ●—●
II ★····★
III □- -□
IV ★—★
☆(0-4) Uruguayan Drug Groups

FIGURE 11

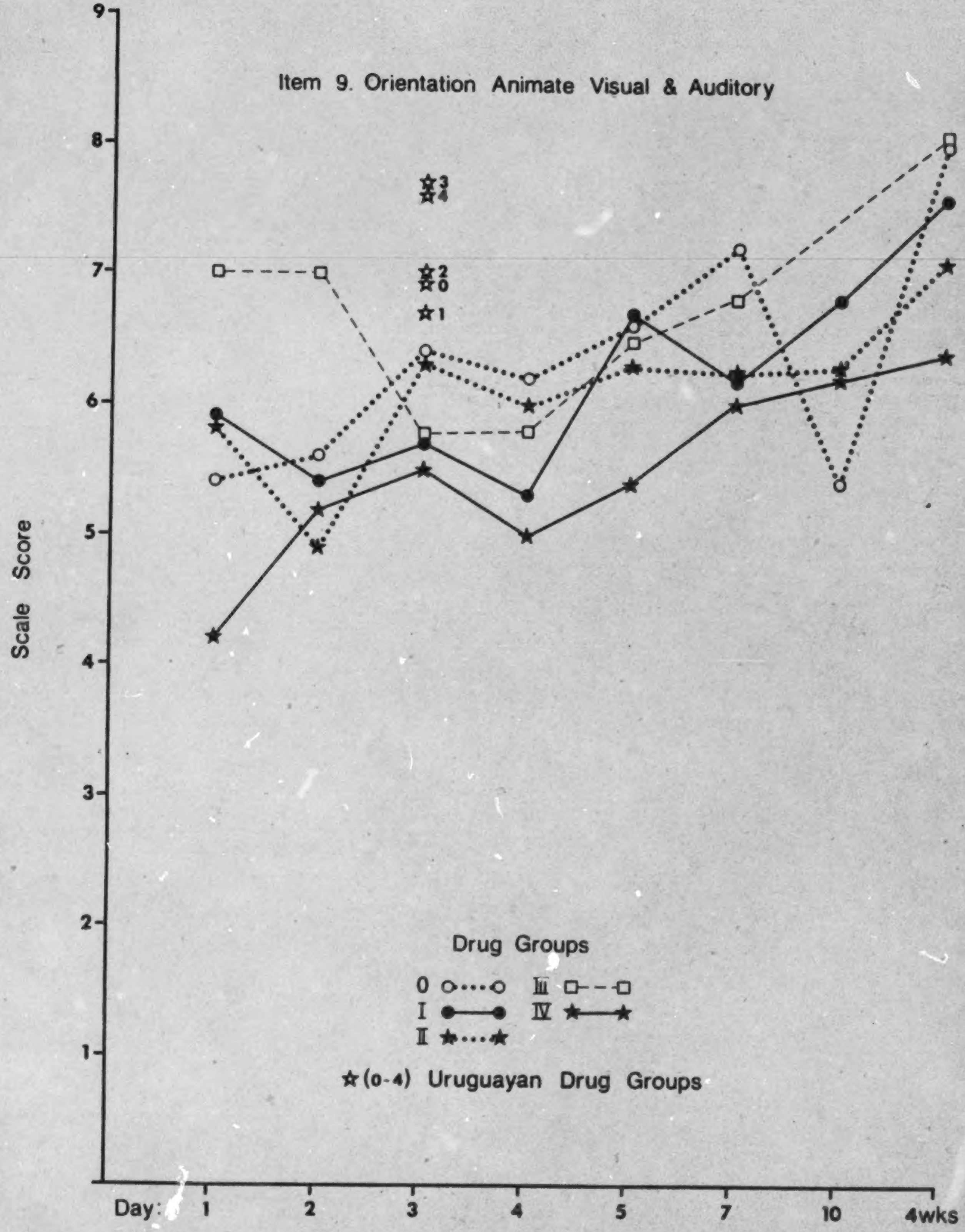
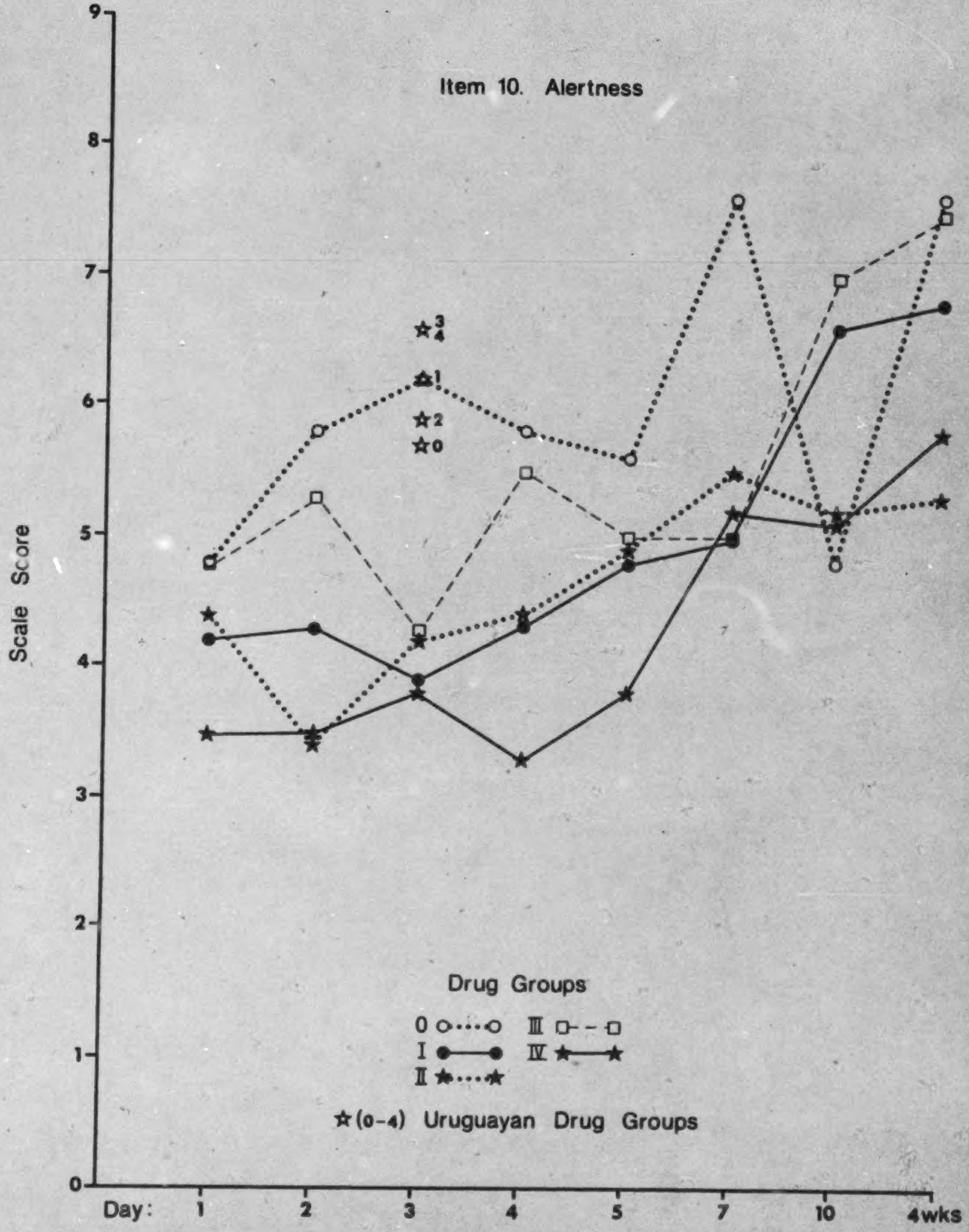

Item 9. Orientation Animate Visual & Auditory
Scale Score
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
☆3
☆4
☆2
☆0
☆1
Drug Groups
0 ○····○
I ●——●
II ★····★
III □‐ ‐□
IV ★——★
☆(0-4) Uruguayan Drug Groups

FIGURE 12



Item 10. Alertness
Scale Score
9
8
7
6
5
4
3
2
1
0
☆3
☆4
☆1
☆2
☆0
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 ○······○
I ●——●
II ★······★
III □- - □
IV ★——★
☆(0-4) Uruguayan Drug Groups

FIGURE 13

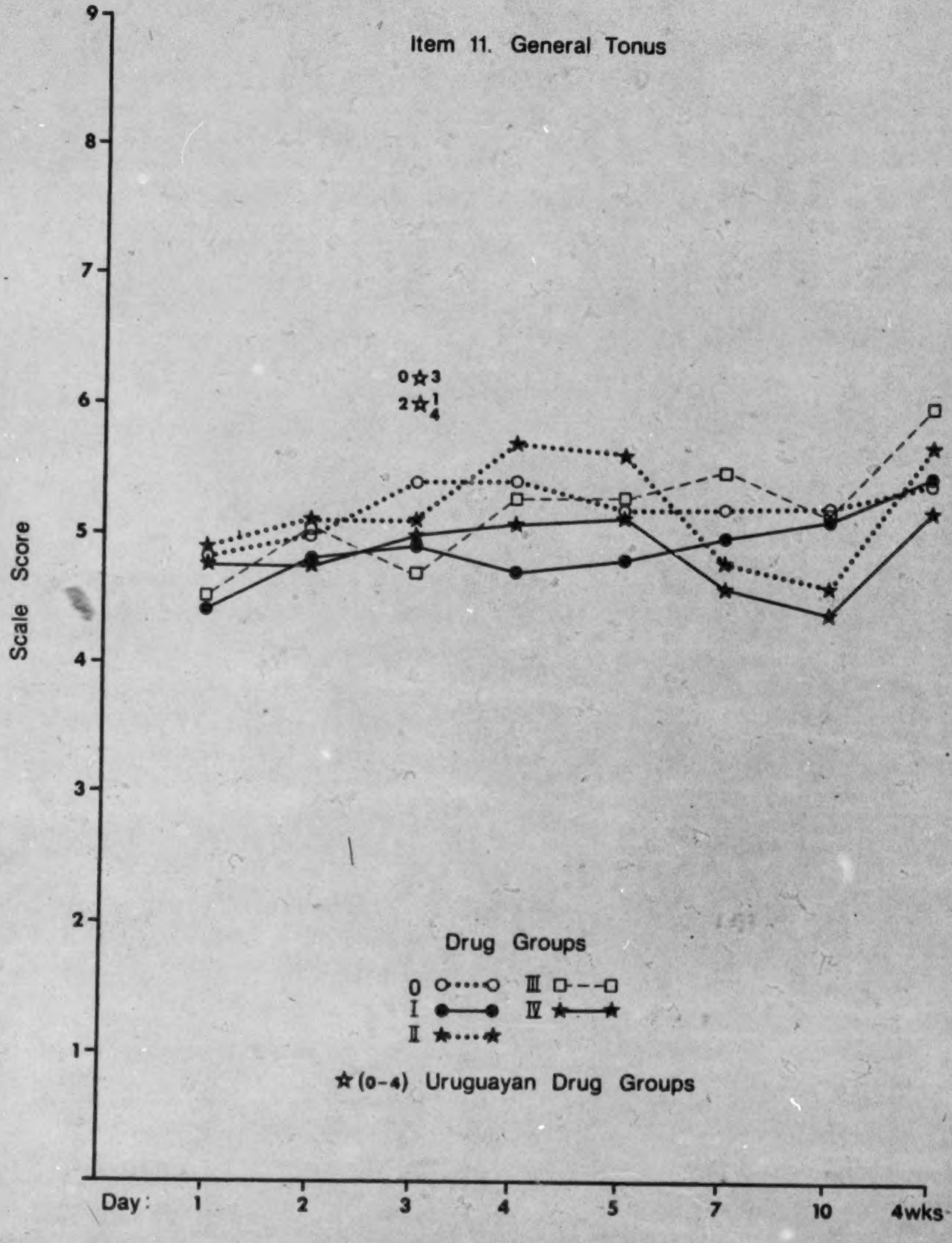

Item 11. General Tonus
Scale Score
9
8
7
6
5
4
3
2
1
Day: 1 2 3 4 5 7 10 4wks
0☆3
2☆1
4
Drug Groups
0 ○····○
I ●——●
II ★····★
III □--□
IV ★——★
☆(0-4) Uruguayan Drug Groups

FIGURE 14

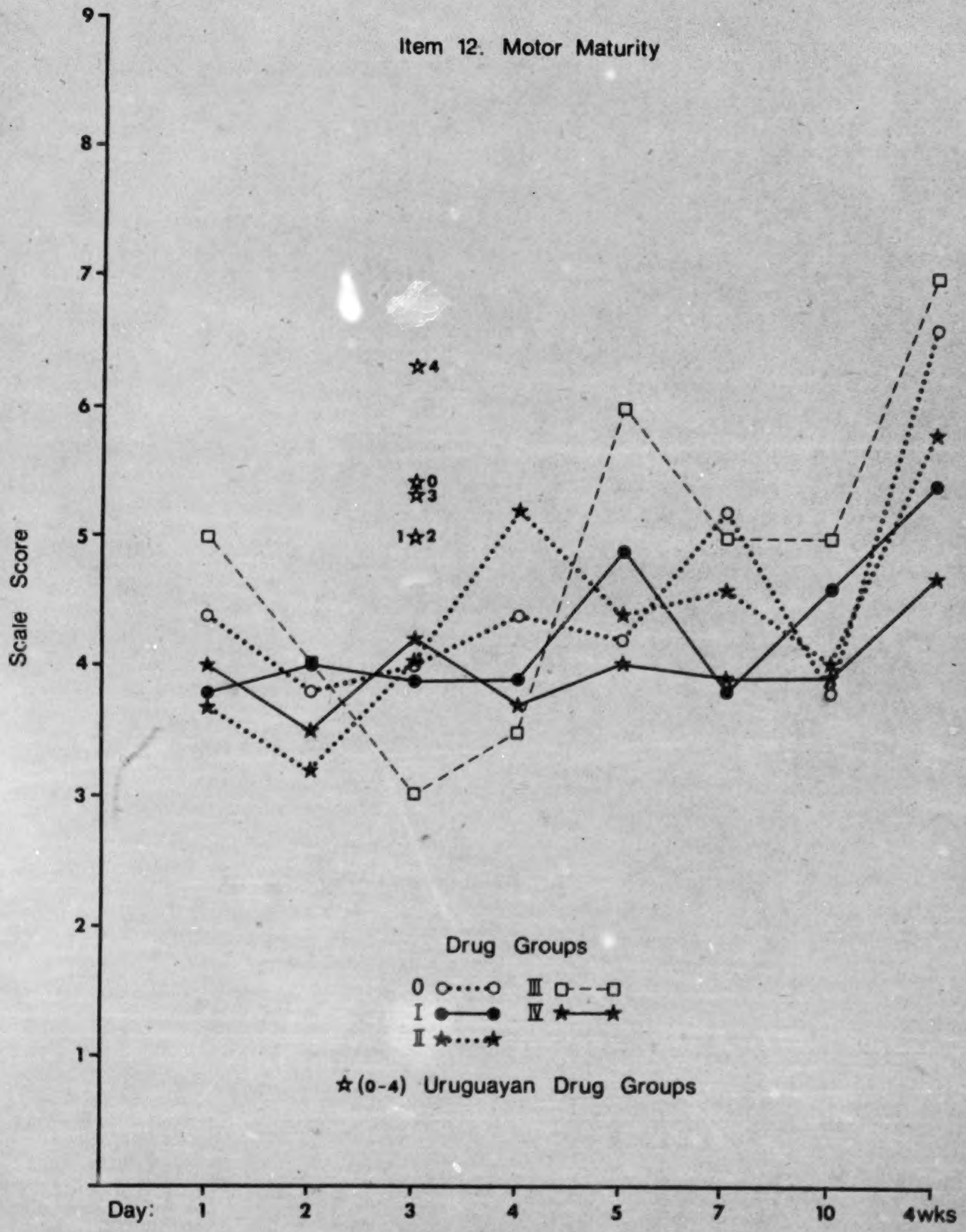
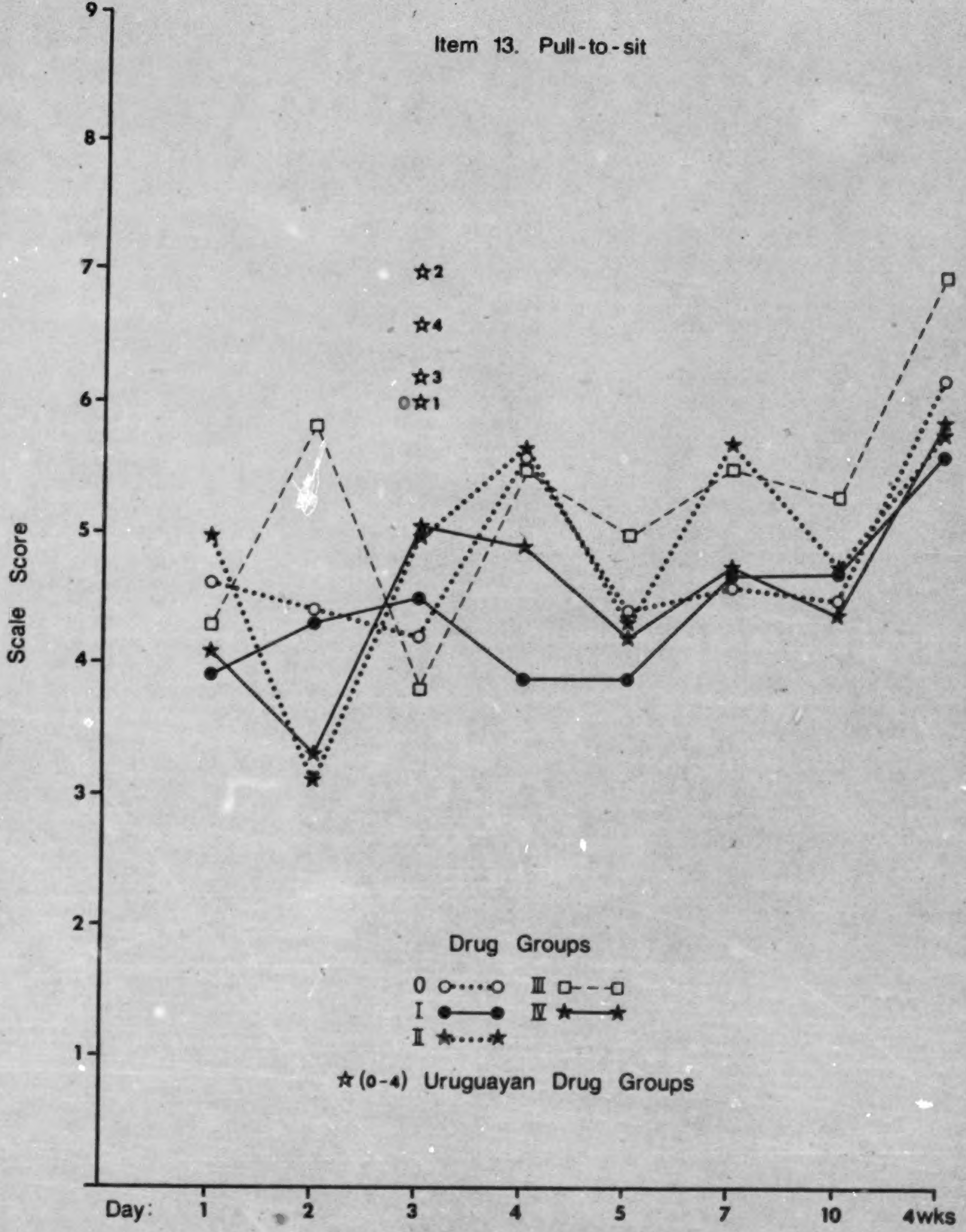
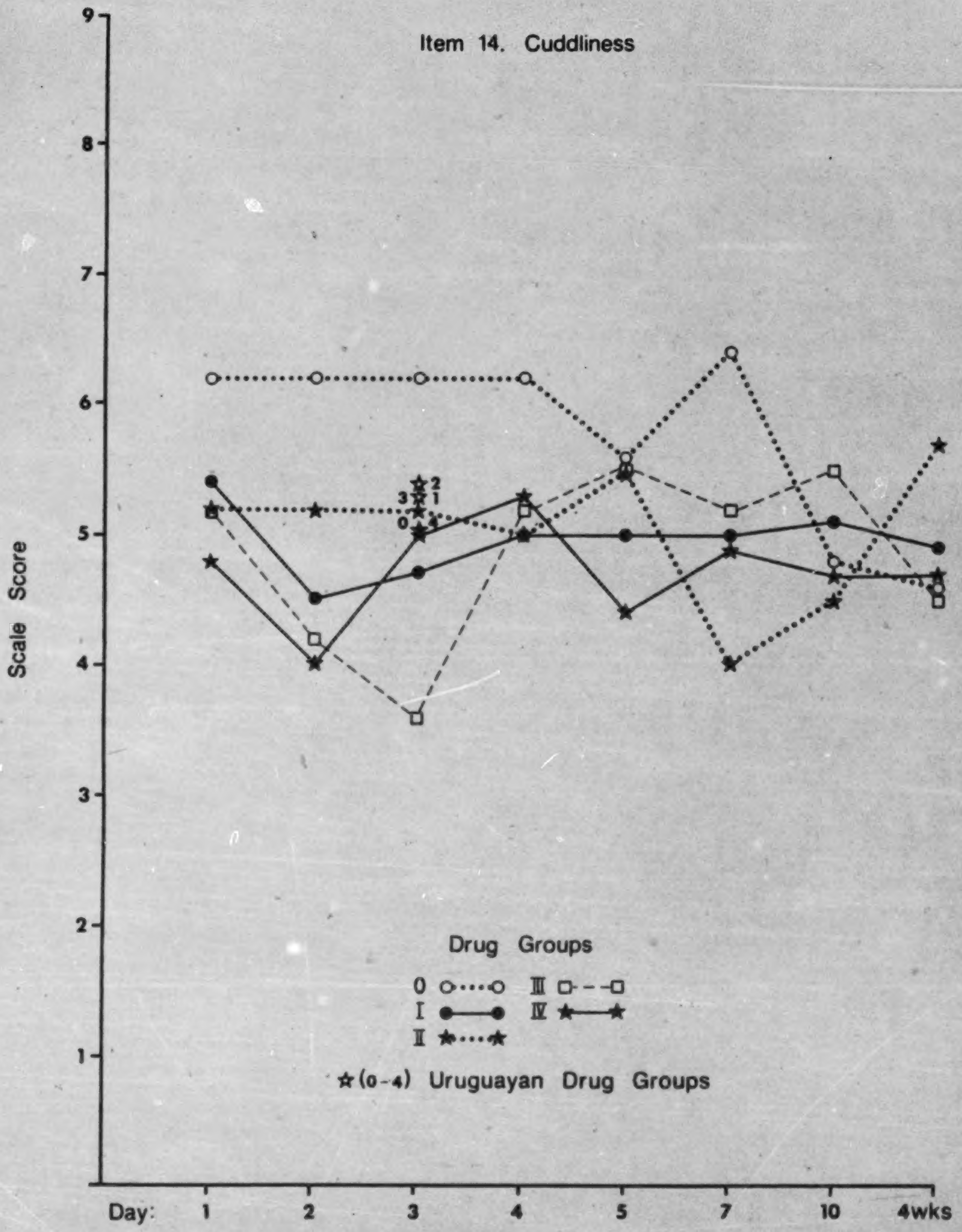

Item 12. Motor Maturity
Scale Score
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
☆4
☆0
☆3
1☆2
Drug Groups
0 ○····○
I ●—●
II ★····★
III □--□
IV ★—★
☆(0-4) Uruguayan Drug Groups

FIGURE 15



Item 13. Pull-to-sit

FIGURE 16


Item 14. Cuddliness
Scale Score
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
2
3
1
0
4
Drug Groups
0 ○·····○
I ●——●
II ★·····★
III □- - -□
IV ★——★
☆(0-4) Uruguayan Drug Groups

CHAPTER I

INTRODUCTION

A potentially important variable in the behavior pattern of newborn infants became apparent to this investigator while testing for individual differences between infants with the Brazelton Neonatal Scale in the University of Kansas Infant Lab. The observed behavior of the infants in the hospital suggested that the durgs administered to the mother during labor and delivery might well affect the newborn in ways that mask or distort his or her behavior.

The original research aim was to study individual behavior patterns of neonates as to whether and how they change over the first month of life. When it became apparent that the drug administered to the mother during labor and delivery might well be an important variable in the infant's behavior during the first month, it was decided that the research should be aimed at discovering how the behavior assessed by the Brazelton Scale was affected by the kinds and amounts of drugs the mother had been given.

The literature dealing with effects of obstetrical medications on the newborn contains a perplexing array of contradictory conclusions. Some authors (Garcia, Waltham and Lubin, 1953; Zaru, Esposito and Zaru, 1967) maintain that even heavy doses of narcotics do not produce significant effects on the newborn while others, like Snyder (1949) and Shnider and Moya (1964) warn that even moderate amounts of a variety of drugs can produce serious side effects. These apparent contradictions can be attributed to three causes:

(a) The effect of a drug depends on several factors such as dosage, route of administration, timing, combination with other drugs, physiological condition of the organism.

(b) Some authors rely on animal studies (Bran and Montalvo, 1971), though it is generally known that conclusions from animal studies do not always apply to humans.

(c) The techniques of examinations and the criteria for determining the presence of side effects differ widely. Some authors, for example, report only gross signs of neonatal depression such as reduction of respiration and heart rate. Other authors go beyond the physical examination and also study different aspects of infants' behavior.

The issue of side effects of drugs on newborn babies is of considerable practical importance because obstetrical medication is widely used. Moreover, in the majority of cases, the drugs are given for relief of discomfort and not for a compelling medical reason; therefore, systematic studies are urgently needed to provide the obstetricians with guidance whether and which drugs to use. Background information about drugs used for relief of pain in obstetrical practice, their classification and use, is presented in Appendix A.

INFANT TESTING

In order to obtain data for the present study there was a need to select a test or measurement that could be objectively administered over a time span from the first hours of life until four to six weeks of age. An assessment that would provide a comprehensive evaluation of the repertoire of the neonate's behavior was also needed.

In the last twenty years, evaluation of the depressive effects of obstetrical medications on the newborn relied heavily on the Apgar score (Apgar, 1953, 1958, 1962, 1966). Few attempts have been made to evaluate the effect of drugs on the behavior of the neonate by means of more extensive tests which could reflect a variety of psychologic and behavioral data. The main reason for this lies in the limited applicability of most infant tests to the study of the first hours or days of life. In addition, not all tests are equally relevant for assessment of the functional state of the newborn organism: some have a narrow range (e.g., screening or neurological tests); others are primarily intended to be developmental scales, i.e., to compare the infant's functional level with the normal distribution curve of those functions among infants of the same age. Developmental scales were primarily intended for early diagnosis of mental retardation (and other developmental deviations) and as research tools for the study of maturational processes (Self and Horowitz, in preparation).

What follows is a brief description of the most commonly used infant tests with emphasis on their applicability to the study of drug effects.

1. Vineland Social Maturity Scale (VSMS) (Doll, 1953. VSMS is a developmental schedule concerned with the individual's ability to cope with the environment and look after his needs. The scale has been found most useful at the younger age level and particularly with the mentally retarded. The Vineland test was standardized on 620 subjects including 10 males and 10 females at each year from birth to 30 years -- too few to ensure adequate reliability and representatives of norms. Moreover, most of the

subjects came from middle-class American homes. The VSMS has only 4 items relating to the first month of life, too few and narrow in range to study the effect of maternal drugs on different behavioral patterns.

2. Bayley Infant Scales of Development (BSID) (Bayley, 1969). This represents a revision and standardization of the California First-Year Mental Scale (Bayley, 1933) and the California Infant Scale of Motor Development (Bayley, 1936) combined with items borrowed from the Gesell, Cattel and other infant tests (see later).

Testing can start at the age of three days but up to the twelfth day only 9 items on the Mental and Motor Scales are available. The Bayley scales have been standardized on a sample of 1262 children from varied socio-economic background and have been supplemented by longitudinal studies. The one-month-old infants were not included in the standardization. Observer reliability was not reported but the study of the California Mental and Motor Scales (Werner and Baylery, 1966, reported by Self and Horowitz, In preparation) revealed 89.4 observer agreement on the Mental Scale and 93.4 on the Motor Scale.

The BSID is well standardized and has been widely used as a research tool. However, its ability to assess infant behavior during the first days and weeks is not known at this point, a fact that limits the applicability of this test to the present research (Self and Horowitz, In preparation).

3. Gesell Developmental Schedules (Gesell and Amatruda, 1947). Since the pioneering sutdies of Arnold Gesell, his Developmental Scales have been widely used as a clinical and research tool. The Gesell Developmental Schedules represent a standardized procedure for observing and evaluating the course of behavior development in the child's daily life in four major areas (i.e., motor, adaptive, language and personal-social) from the age of four weeks to 36 months. The omission of the first four weeks alone limits the applicability of GDS for this research.

   There are several mental development scales more or less dependent on Gesell's early findings and concepts. Among others one should mention the Linfert-Hiersholzer Scale for measuring the Mental Development of Infants (Self and Horowitz, In preparation); The Northwestern Infant Intelligence Tests (Gilliland, 1948; Gilliland, 1949a cited by Self and Horowitz, In preparation) and the Viennese Test developed by Frankl and Wolf (1934) in Self and Horowitz (In preparation).

4. Other Developmental Scales. Another type of testing is provided by special revisions and downward extensions of the Binet Scales. Kuhlmann's 1922 version of the Binet extended the scales down to a three-month level. In 1939, revision of the Kuhlmann-Binet likewise covers most of the infant period.

   A scale that many psychologists consider one of the most satisfactory instruments for infant testing is the Cattel Infant Intelligence Scale -- a downward extension of the 1937 Stanford-Binet Form L. The items are grouped into age levels and the MA and ratio IQ are computed by the same procedures followed in the 1937 Stanford-Binet. The Cattel Scale extends from 2 to 30 months. The small intervals between age levels, as well as the relatively large number of tests at each level, permit more precise measurement with this scale than is possible with most other available infant tests. Continuity and comparability with the Stanford-Binet are further advantages. The Cattel Scale was standardized only on 274 subjects who came from lower middle-class families of North European extraction. Since both these tests can be utilized only at the age of 2-3 months, they are not suitable for studying the immediate effects of obstetrical medications on the newborn.

5. Neurological Tests. Neurological tests often are specifically designed for early identification of deviations or abnormalities. A French team (Andre-Thomas, Chesni and Saint Anne Dargassies, 1960) has described a scheme for neurological examination of the infant and another one was suggested by Prechtl and Beintema (1964). The latter was standardized on 1500 children, many of whom have been followed for up to eight years and theobserver reliability, was .80 to .96 (Prechtl , 1963). The examinations have been conducted from the first day of life, and though results during the first three days are less valid than those observed later (Beintema, 1968) the test serves as a reliable measure of gross neurological disturbances. Its applicability to the study of other possible effects of obstetrical drugs that are not necessarily neurological is limited (see Appendix A).

6. Graham Behavior Test for Neonates. A different approach to assessment of abnormality and specifically brain injury in the newborn is represented by Graham Behavioral Test for Neonates (1955). The tests consist of five scales:

(a) pain threshold;

(b) maturation scale;

(c) visual response;

(d) irritability scale; and

(e) muscle tension.

The Graham Test was standardized on 176 presumably normal infants and on 81 infants with presumed brain damage (Graham, Matarazo and Caldwell, 1956). Its range is from the first day of life until the age of fourteen days and therefore it was found unsuitable for this research which follows up the effect of drugs up to one month. It also samples a very limited part of the behavioral repertoire of the neonate.

7. Brazelton Newborn Assessment Scale. Brazelton (1972) has developed a relatively comprehensive infant test, covering a wide range of functions, from neurological examination based on Prechtl and Beintema's procedure to such social variables as degree of cuddliness. Many items of the Graham Scale are found also in the Brazelton Scale.

A detailed description of the scale is found in Appendix B and C and what follows is an outline of it.

The Scale form provides for the recording of details about parents, newborn's physical condition at birth, weight, and delivery procedure and any abnormalities detected at birth. The examination of the infant begins with a two-minute observation of the newborn before the examiner attempts to elicit responses. The baby's state, i.e., deep sleep or alertness, crying, etc., is recorded. After the initial observation period, stimulation is applied in a sequence suggested by the scale, but -- in contrast to most psychological tests -- it is not a strict sequence. The examiner adjusts the order to the baby's reactions, e.g., if the baby is crying and nothing but a pacifier soothes him, the examiner will offer a pacifier, though sucking reflex is noe of the last items to be tested on the scale. The philosophy of the Brazelton Scale is to elicit the infant's best behavior. There is no time limit or an emphasis on speed. The initial stimuli are presented to the infant before he is disturbed and while he is in one of three states 1, 2, and 3 (see Appendix B). After an assessment of his initial state (1, 2, 3), stimuli which can be offered discretely are presented -- auditory and visual. While the infant is in the wrapped, quiet situation, the flashlight is presented nine times. The reaction is recorded after each presentation, and the infant allowed to quiet again before a second stimulus is offered. If three successive presentations produce no response the trials are terminated or a total of nine trials is given. After the flashlight, a rattle is used in the same way. Unless the infant has come to an alert state during presentation of the rattle, the bell is next presented for up to nine trials. (Often the infant will begin to rouse after the above stimulation.)

After the three habituation series with the flashlight, rattle and bell the infant is uncovered, and any relevant reactions to this change are noted (e.g., skin color changes, movement, arousal, etc.).

While the infant is quiet, a light pinprick is applied to his or her foot (four times). The amount of withdrawl, spread to other parts of the body, or an "all or none" response characteristic of an immature organism is observed. Again, repeated pinpricks are applied after the infant quiets from the last in order to assess his or her ability to shut down his response to the stimulus. Meanwhile, an assessment of speed of state-change is made as the infant moves to wideawake alertness. Clonus (ankle), and foot grasp, and Babinski typically are determined next.

The baby may be undressed at this point, and be observed for state change, lability of skin color, speed of build-up, etc., as one undresses and disturbs him or her. General tone is assessed as the infant is handled and when he or she is first undressed, alert and not disturbed. Passive movements are graded at this point while the infant is awake, but not disturbed. The infant should be tested for auditory responses to the rattle and bell at this time.

So long as the infant remains in an awake state, the infant can also be pulled to sit. Standing, walking, and placing reflexes follow easily. Then incurvation, body tone across the examiner's hand, and prone responses are assessed. The infant is picked up and held, spun around slowly for vestibular responses and nystagmus (for the description of these maneuvers, refer to Prechtl and Beintema, 1964). Holding the infant for subjective responses usually follows these items.

As final and disturbing maneuvers, the cloth-on face, the tonic neck reflex (TNR) and Moro reflexes are tested. Since these maneuvers are disturbing, they provide an excellent opportunity to console the infant. In this the infant's reactions to graded attempts to quiet him or her are noted.

Whenever the infant becomes upset (e.g., especially after testing the cloth-on-face and Moro reflexes mentioned below) the examiner waits 15 seconds before attempting comforting procedures. This allows the infant an opportunity to quiet himself or herself and the behavior which occurs in self-quieting should be carefully observed. If no self-quieting occurs, an attempt to comfort the infant is made in a graded series that first involves talking, then tactile contact, then holding and then rocking. Such measures as hand to mouth behavior, tremulousness, amount of startle, vigor, and activity are noted all during the exam. Additionally, the number of clear state changes that occur are counted throughout the exam, (Manual for the Assessment of Neonatal Behavior by Brazelton, Freedman, Horowitz, Kostowsky, Ricciuti, Sameroff and Tronic, In press).

The main items on the Brazelton Scale are scored on a nine point scale. A set of items relating to neurological functions are rated on a three point scale corresponding to hyporeactive, average and hyperreactive. Lack of/or uneven responses (i.e., good muscle tone only in left arm and left leg) are also recorded. The relatively wide range of infant behaviors assessed by the Brazelton Scale and the scale's applicability from the first day of life until the age of four weeks (certain items apply up to the age of ten weeks), make it pre-eminently suited for:

(a) studying individual behavioral patterns during the first month of life,

(b) the effect of obstetrical medication on the neonates.

CHAPTER II

METHOD

This chapter describes the subject sampling and method of obtaining the sample, testing procedure, testers' reliability and testers' assignment.

SUBJECTS

Fifty infants participated in this study: twenty-nine females and twenty-one males, out of which 25 females and 14 males were born in Stormont Vail Hospital in Topeka, Kansas and 4 females and 7 males in Lawrence Memorial Hospital, Lawrence, Kansas. Three female infants diagnosed by the physicians as being premature or showing evidence of illness or congential abnormalities were excluded from the statistical analyses. In addition, three other subjects (males) were excluded because testing was incomplete. The remaining forty-four subjects constituted the basic sample of infants.

Birth order for females in the sample included 15 first born, 7 second born, 3 third born, and 1 fifth born. Among the males there were 9 first born, 7 second born, 1 third born, and 1 fourth born. Birth weight for females ranged from 5 lb. 16 oz. to 10 lb. 3 oz. with a mean 7 lb. 14.5 oz.; for males the range was 6 lb. 15 oz. to 8 lb. 11.5 oz. with a mean 8 lb. 2 oz.

SELECTION OF SUBJECTS

A few mothers gave their consent for their infant's participation in the study in the doctor's office (see Appendix D). The majority gave their consent in the labor room or in the maternity ward (a few hours after delivery) to the nurses who suggested they participate in a developmental study. In a few cases, consent was given to the instructor in a LaMaze prenatal relaxation course. These consent forms were sent directly to Stormont Vail nursery. Mothers of female infants in the study ranged in age from 18 years to 33 years with a mean of 24.5 years; mothers of males were from 17 years to 37 years of age with a mean of 25.2 years. Families belonged to different socio-economic levels, as judged by father's occupation: Social workers - 2, Lawyers - 2, University students - 10, Computer programmers - 3, Teachers - 2, Accountant - 1, Insurance man - 1, Veterinarians - 1, Fireman/mailman/baker-1 each, soldiers - 3, mechanics - 6, salesmen - 2, unskilled workers - 3, construction worker - 1. Four of the mothers were unwed and their socio-economic status was not judged. Of the fifty subjects, four were black or of mixed racial background, the remainder were caucasians.

ASSESSMENT PROCEDURE

The author or another infant laboratory staff member was notified by the hospital nurse as soon as the newborn was examined, its temperature stabilized and presence of gross abnormalities excluded.

The infants were tested eight times altogether: daily from first through fifth day, on the seventh and tenth days and at four weeks. On the first day females tested at the average age of 16.22 hours with a range of 7.5 - 23 hours; the average age for males was 16.58 hours with a range of 8 - 23 hours. After the first day subjects were tested approximately 24 hours later for day 2 - 5. On day 7 and 10, babies were tested at home at convenient times for the mother, usually in the morning. At four weeks testing was measured in days: the mean was

28.38 days with a range of 28 to 33 days for females; for males the mean was 28.24 days with a range of 28 to 30 days.

While in the hospital, the infants were brought into the testing room in a crib to which a chart was attached containing only the following information: last name, sex, weight and name of the physicians.

An attempt was made to start the examination when the infant was asleep but this was not always possible. The attempts were made to examine the infants not later than two hours after feeding. The infant was observed for approximately two minutes before any stimulation began. The stimuli used for the Brazelton Scale included: a small penlight, a rattle (an aluminum film can filled with buttons), a toy bell, a diaper pin, a diaper and a sterilized bottle nipple, and the examiner's voice, face and tactile contact. These were applied in a manner described in Chapter I and in Appendix B.

TESTERS' RELIABILITY AND TESTERS' ASSIGNMENT

Seven testers (two living in Topeka and five in Lawrence) participated in this study. Inter-tester reliability as measured on babies not participating in the study ranged from .90 to .96. Each baby was tested by at least three testers on different days and some infants by four or more. For any particular examination the choice of tester depended on:

(a) Time of birth, i.e., night testing was performed by examiners living in the location of the hospital.

(b) Number of babies tested in that specific day.

(c) Conditions of the roads, i.e., whether snow or rainstorm prevented commuting.

(d) Sickness, e.g., an examiner who had a respiratory infection stayed away from the infants and another one took over.

Testers had direct contact with the mothers for the first time on the fourth or the fifth day post partum just before mother and infant left the hospital. Each examiner knew only the details necessary for identification of the infant; no medical data nor information about drugs were available. Examiners did not communicate with each other regarding any test results to avoid any possible biasing. Only when all the Brazelton data were collected, (i.e., after the fourth-week examination) were the medical data obtained from the hospital obstetrical charts.

CHAPTER III

RESULTS

The scores for all items on all tests and the scores of state (see below) were punched on computer cards along with six control variables (see below). The data from eight repeated testings were analyzed in several ways and this chapter will describe them as well as the results of these analyses.*

1) Control Variables

Six control variables were identified and copied from the hospital records: sex (assigned a score 0 for females and a score 1 for males), birth weight in ounces, mother's age, number of pregnancies (parity) and the number of living siblings, excluding the subject.

2) State Scores

There were twenty-four state variables; three per each testing day: Initial State and two Predominant States. The state range was from a score of 1 to 6.

1 - very deeply asleep
2 - lightly asleep
3 - drowsy
4 - moderately alert
5 - alert
6 - crying

For more detailed description the reader is referred to Appendix B.

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*The statistical analysis was performed with the help and councelling of a statistician.

3) Brazelton Items

Two hundred and sixteen Brazelton Scale items were included: Twenty-seven items over eight testing days.

4) Drug Data

Twenty-six different drugs were used in our sample. The drug data were arranged in two ways: (a) Seven drug type groups were set up according to principal pharmacologic properties: local and regional anesthetics, tranquilizers, narcotics, barbiturates, general anesthetics, scopolamine, and muscle relaxants. These drug group comprised the twenty-six individual drugs used in our sample (see Appendix G, Table 1). (For detailed explanation of mode of administration and effect of these drugs see Appendix A),, (b) The subjects were grouped into five dosage groups as follows: 0 - no medication; I - light medication; II - medium medication; III - heavy medication; IV - general anesthesia.

The drug scores were punched on computer cards along with results obtained from previous analyses of the data (to be described in this chapter) and correlated using Perrson r correlation.

I. Control Variables

Each control variable (sex, race, birth weight, mother's age, parity and number of living children) was intercorrelated using Pearson r with all the other variables, i.e., state variables, Brazelton Scale items and drug variables for each testing day separately, and what follows is the result of the analysis.

A. Control Variables as Related to State Variables

State was correlated with each control variable. The only significant findings were: Birth weight was found to have a significant negative correlation with Initial State and Predominant State on Day Four. These are shown in Table 1. That is the heavier babies showed greater tendency to be asleep and less tendency to be alert and/or cry at the start and during the testing. Number of living children was found to have a negative correlation with Predominant State 1 on Day One, that is babies with higher order of birth had a greater tendency to be asleep and less tendency to be alert and/or cry during the test. This analysis involved a total of 144 correlations at the .01 level, two would be expected to reach this level by chance alone. Since 2 correlations were significant at this level, they were discussed only if they appeared in conjunction with higher levels of significance.

B. Control Variables as Related to Brazelton Scale Items

Each control variable was correlated with the item scores on the Brazelton Scale. This involved a total of 1296 correlations. The significant results were: birth weight was found to have significant correlations with some of the Brazelton Scale items on different testing days. Birth weight was negatively correlated with Orientation to inanimate visual stimuli. That is, the heavier the infant was at birth the less responsive he or she was to the sight of the rattle or the bell. Birth weight also had other negative correlations with Alertness and a very consistent negative correlation with Muscle tone. The higher the birth weight, the less alert the infant was and the lower the general muscle tone was.

Birth weight was positively correlated with Lability of skin color, Lability of state, and Hand-mouth facility. In other words, heavier infants showed more rapid changes of their skin color, were more labile, i.e., switched from sleep to alertness and/or cried and quieted down

TABLE 1

CONTROL VERSUS STATES

		Significant Correlations					
DAY	STATE	SEX	RACE	BIRTH WEIGHT-OZ.	MOTHER'S AGE	NO. OF PREGENANCIES	NO. LIVING CHILDREN
Day One	Initial State						
Day One	Predominant State 1						- .48***
Day Four	Initial State			- .38**			
Day Four	Predominant State 1			- .47***			
Day Ten	Predominant State 1						- .40**

p >.001***

p >.01**

p >.05*

more often. Heavier babies also exhibited more efficiency in sucking their hand or finger. Mother's age was the only other control variable that was significantly correlated with Response decrement to light and negatively correlated with Pull to sit. In other words, the older the mother, the quicker the habituation to light and the shorter the time the infant could hold his head erect when pulled to a sitting position. Since there were a total of 1296 correlations in this analysis, 13 would be expected to reach the .01 level of significance by chance, and 65 the .05 level of significance by change. Altogether there were 11 correlations significant at $p > .001$; 8 correlations significant at $p > .01$, ten correlations of $p > .05$ and two at $p > .10$, the latter were evaluated in conjunction with higher levels of significance. Exact values are shown in Table 2.

C. Control Variables Correlated with Drug Scores

Each of the six control variable was correlated with the twenty-six individual drugs and the seven drug type groups using Pearson r correlations. No control variables were found to have correlations significant beyond chance with the drug variables.

In summary, out of the six control variables birth weight was the only one that showed a pattern of significant correlations, i.e., negative correlation with Orientation, Alertness and Muscle tone, as well as Initial and Predominant State (on the fourth day). The consistent pattern of heavy infants exhibiting weaker Muscle tone throughout the first month of life, as well as reduced alertness over the first ten (or more) days of life, was particularly noticeable. Birth weight also showed a positive correlation with Lability of skin color,

TABLE 2

CONTROL VARIABLES VERSUS BRAZELTON SCALE ITEMS

Significant Correlations

DAY	BRAZELTON ITEMS	BIRTH WEIGHT IN OUNCES	MOTHER'S AGE
Day 1	Response decrement to light		.55***
Day 4	Orientation inanimate visual	- .39**	
Day 3	Alertness	- .36*	
Day 4	Alertness	- .49***	
Day 10	Alertness	- .47**	
Day 1	General Tonus		
Day 2	General Tonus	- .48***	
Day 3	General Tonus	- .36*	
Day 4	General Tonus	- .32*	
Day 5	General Tonus	- .36*	
Day 7	General Tonus	- .35*	
Day 10	General Tonus	- .28	
Day 28	General Tonus	- .28	
Day 10	Pull to sit		-.51***
Day 3	Irritability	.35*	
Day 28	Irritability	.43**	
Day 4	Startles	.43**	
Day 5	Startles	.34*	
Day 5	Lability of skin color	.34*	
Day 7	Lability of skin color	.48***	
Day 10	Lability of skin color	.31*	
Day 1	Lability of states	.30*	
Day 3	Lability of states	.47***	
Day 10	Hand mouth facility	.44**	

$p > .001$***

$p > .01$**

$p > .05$*

Lability of state and Hand-mouth facility. There were two isolated highly significant correlations: Number of living children was negatively correlated with Predominant State I and mother's age was positively correlated with Response decrement to light and negatively with Pull to sit.

2. State Factors

"State" variable describes the condition of the subject in reference to the judgment by the examiner of the infant, along the continuim of sleep to awake to crying. Sleep of varying length, alertness or crying, is scored over a range of 1 to 6 (for detailed definition see Appendix B). Three state factors were scored: Initial State at the beginning, i.e., before applying stimulations, and two Predominant States during the examination. In this manner twenty-four State variables were obtained over eight testing days. Analyses of the State variables were related to their intercorrelation, correlations with Brazelton Scale items, and correlations with drug variables, always using Pearson r correlation.

A. State Variables Intercorrelated Over Eight Testing Days

As shown in Table 3, Predominant State 1 and Predominant State 2 were significantly correlated over all testing days. The range of state variability was relatively narrow on any given testing day. For example, if the first Predominant State was light sleep then the second Predominant State would more likely be either deep sleep or drowsiness rather than alertness. Since there were 72 correlations none would be expected to reach the .01 level by chance. There were five correlations at the $p > .001$ level of significance and 3 at $p > .01$ level of significance.

TABLE 3

STATE INTERCORRELATED OVER EIGHT TESTING DAYS

Significant Correlations

DAY	STATE	INITIAL STATE	PREDOMINANT STATE 1	PREDOMINANT STATE 2
Day 1	Initial State		.30*	
	Predominant State 1			.41**
	Predominant State 2			
Day 2	Initial State			
	Predominant State 1			.38**
	Predominant State 2			
Day 3	Initial State			
	Predominant State 1			.65***
	Predominant State 2			
Day 4	Initial State		.34*	
	Predominant State 1			.50***
	Predominant State 2			
Day 5	Initial State			
	Predominant State 1			
	Predominant State 2			.47**
Day 7	Initial State		.37*	
	Predominant State 1			.70***
	Predominant State 2			
Day 10	Initial State			
	Predominant State 1			.67***
	Predominant State 2			
Day 28	Initial State			
	Predominant State 1			.81***
	Predominant State 2			

p >.001***

p >.01**

p >.05*

B. State Variables Correlated with Brazelton Items Over Eight Testing Days

State variables had a significant correlation with sixteen of the twenty-seven items. In all, this analysis involved 648 correlations. Exact values are shown in Table 4.

Initial States: Deep sleep which has the score of 1, light sleep which is scored 2, and drowiness which is scored 3, were each negatively correlated with Response decrement to light, rattle and bell. In other words the more sleepy the infant was at the beginning of the examination, the less he or she habituated to these stimuli.

Initial State was positively correlated with the different orientation responses. That is, the higher the state score, falling in the range of 5 (Alert) or 6 (Crying) the more the infant responded to the inanimate stimuli (bell, rattle) as well as to the animate stimuli (human face and voice); the more alert the infant was and the irritable he or she was.

Initial State was positively correlated with smiling on Day Seven but negatively on Day Ten. That means that infants who were more sleepy at the beginning of the examination on Day Seven would smile more, but on Day Ten the initially alert infants smiled more.

Predominant State 1 was positively correlated with Response decrement to bell, i.e., the less sleepy infants habituated more rapidly to the auditory stimuli. It was also positively correlated to all the orientation items, i.e., the less sleepy infants responded more to the visual and auditory inanimate stimuli as well as to the animate (human face and voice) stimuli.

TABLE 4

STATE VARIABLES CORRELATED WITH BRAZELTON SCALE ITEMS OVER EIGHT TESTING DAYS

Significant Correlations

DAYS	BRAZELTON SCALE ITEMS	INITIAL STATE	PREDOMINANT STATE 1	PREDOMINANT STATE 2
Day 1	Response decrement-light	- .48***		
Day 2	Response decrement-light	- .52***		
Day 3	Response decrement-light	- .41**		
Day 5	Response decrement-light	- .37**		
Day 28	Response decrement-light			.34*
Day 1	Response decrement-rattle	- .34*		
Day 3	Response decrement-rattle	- .57***		
Day 5	Response decrement-rattle		- .30*	
Day 28	Response decrement-rattle			- .52***
Day 2	Response decrement-bell	- .36*		
Day 5	Response decrement-bell		.40**	
Day 28	Response decrement-bell	- .54***	.41**	
Day 1	Orientation inanimate visual		.47**	
Day 2	Orientation inanimate visual		.57***	
Day 3	Orientation inanimate visual		.42**	
Day 4	Orientation inanimate visual	.30*		
Day 7	Orientation inanimate visual	.35*		
Day 1	Orientation inanimate auditory		.31*	
Day 2	Orientation inanimate auditory		.49***	
Day 4	Orientation inanimate auditory		.37*	
Day 7	Orientation inanimate auditory		.52***	
Day 1	Orientation animate visual		.48***	
Day 2	Orientation animate visual		.53***	
Day 3	Orientation animate visual		.31*	.52***
Day 4	Orientation animate visual		.39**	
Day 7	Orientation animate visual		.40**	
Day 1	Orientation animate, visual, and auditory	.35*	.36*	
Day 2	Orientation animate, visual, and auditory		.54***	
Day 3	Orientation animate, visual, and auditory		.48***	
Day 4	Orientation animate, visual, and auditory	.31*	.41**	
Day 5	Orientation animate, visual, and auditory	.35*		

TABLE 4 (continued)

DAYS	BRAZELTON SCALE ITEMS	INITIAL STATE	PREDOMINANT STATE 1	PREDOMINANT STATE 2
Day 7	Orientation animate, visual, and auditory		.43**	
Day 1	Alertness	.41**	.48***	
Day 2	Alertness		.54***	
Day 3	Alertness	.37*	.48***	
Day 4	Alertness		.34*	
Day 5	Alertness		.31*	
Day 7	Alertness		.55***	.34*
Day 1	Peak of excitement			.40**
Day 3	Peak of excitement			.68***
Day 5	Peak of excitement			.37*
Day 10	Peak of excitement			.46**
Day 1	Rapidity of build up	.32*		
Day 3	Rapidity of build up			.36*
Day 4	Rapidity of build up		.40**	.35*
Day 7	Rapidity of build up	.33*		
Day 1	Irritability			.42**
Day 2	Irritability			.31*
Day 3	Irritability			.42**
Day 4	Irritability			.36*
Day 10	Irritability			.51***
Day 28	Irritability	.38**		
Day 4	Startle			.31*
Day 5	Startle		- .30*	
Day 28	Startle	- .41**		
Day 1	Lability of skin color			.35*
Day 28	Lability of skin color			.44**
Day 1	Lability of states			.35*
Day 3	Lability of states			.36*
Day 5	Lability of states		.40**	.46**
Day 10	Lability of states			.34*
Day 3	Self quieting activity			- .39*
Day 10	Self quieting activity			- .41**
Day 28	Self quieting activity			- .30 *
Day 1	Smiling	.30*		
Day 3	Smiling		.40**	
Day 4	Smiling		- .34*	- .35*
Day 7	Smiling	- .50***	- .46**	- .53***
Day 10	Smiling			- .41**

p >.001*** p >.01** p >.05*

Predominant State 1 was positively correlated with Alertness (which is self-evident, since Alertness is reflected by Predominant State scores) and also with Rapidity of build up and Lability of state. In other words, the more alert the newborn, the fewer aversive stimuli were applied before the infant started to cry. The positive correlation with Lability of state means that the more alert or crying was the infant, the more he or she tended to move from one state to another, while the babies who were deeply asleep tended to stay so.

An inconsistent relation was found between Predominant State 1 and smiling. On Day One it was positive, on Day Four and Seven negative, i.e., newborn who were sleepy on the first day smiled less, but on Day Four or Seven, the newborns who were alert and/or crying, smiled less.

Predominant State 2 was negatively correlated with Response decrement to rattle on Day Twenty-Eight only. That is, the sleepier the infant was the more he or she habituated to the noise of the rattle at the age of one month. Predominant State 2 was also negatively correlated with Self-quieting activity on Day Twenty-Eight and with Smiling on Day Four, Seven and Ten. In other words, sleepier babies quieted themselves better at the age of one month and smiled more throughout the Days Four to Ten (a finding similar to that of Predominant State 1). Predominant State 1 was positively correlated on Day Three only with Orientation to animate visual stimuli, i.e., the more alert and/or crying the newborn, the more responsive he or she to the visual stimuli. Predominant State 2 was positively correlated with Peak of excitement, i.e., the babies who were more often alert and/or crying cried more and for longer periods. Predominant State 2 was also positively correlated with Irritability, Lability of skin color and Lability of state. In other words, the newborns who were more alert and/or crying were also more irritable, had more changes in skin color and changes of state (e.g., sleep to alert). The latter was also found to be significantly correlated with Predominant State 1 (see above).

The relation between the three states (Initial, Predominant 1, and Predominant 2) and the behaviors measured by the Brazelton Scale over eight testing days, were generally quite consistent. Exact values are represented in Table 4.

A total of 648 correlations were done in these analysis and 7 could be expected to reach the .01 level by chance. There were twenty-one correlations significant at $p > .001$ and twenty-five significant at $p > .01$, which is beyond the chance expectation. Correlations significant at $p > .05$ were treated only if they appeared in conjunction with higher levels of significance. The exact significant correlations are shown in Table 4.

3. Brazelton Items Intercorrelated Over Eight Testing Days

A. Items and Days

Each Brazelton item was intercorrelated with itself over the eight testing days using Pearson r correlation. The significant results are shown in Table 5. For each item there were a total of seven correlations possible over the eight testing days. Thus one would expect no item to reach the .01 (or .05) level by chance.

TABLE 5

BRAZELTON ITEMS INTERCORRELATED OVER EIGHT TESTING DAYS

Significant Correlations

BRAZELTON ITEMS	DAY	1	2	3	4	5	7	10	28
Response decrement to light	1			-.41**	-.31*				-.53***
	2								-.53***
	4							.43**	
	5							-.41**	
	7							.31*	.54***
	10								.64***
Response decrement to rattle	1					.49***			
	5							.69***	
Response decrement to bell	2					.30*			.80***
Response decrement to pinprick	3							-.40**	
Response inanimate visual	1		.33*		.49***				
Response animate visual	1		.50***	.37*	.35*	.42**	.37*		
	4					.39**	.38**		
	7							.49***	
Response animate auditory	5						.43**		
Response animate visual and auditory	1		.43**	.43**		.35*			
	3				.41**	.33*			
Alertness	3				.52***				
General Tonus	1		.48***	.38**	.56***		.60***	.47**	
	2				.50***	.36*	.33*	.44**	.43**
	3				.56***			.50***	.43**
	7							.43**	.34*
	10								.43**

TABLE 5 (continued)

BRAZELTON ITEMS	DAY	1	2	3	4	5	7	10	28
Motor maturity	4								.39**
Pull to sit	3				.38*				
Cuddliness	4					.46**			
Peak of Excitement	1						.46**		
	3							.52***	
	4							.42**	
Tremulousness	3				.30*			.39**	
	4							.40**	
	5							.48***	
Lability of skin color	1		.51***	.37*					
	3				.65***				
Lability of state	1		.41**				.36*		
	2							.43**	
	4					.32*		.46**	.38**
	5							.39**	
	7							.46**	
Smiling	1		.53***	.73***	.48***	.50***		.78***	.40**
	2			.68***	.47***	.58***	.44**		
	3				.31*	.36*		.57***	
	5						.55***		

$p > .001$***

$p > .01$**

$p > .05$*

Item 1, Response decrement to light on Day One was negatively correlated with itself on Days Three, Four and Twenty-Eight; it was negatively correlated on Days Two and Twenty-Eight; it was positively correlated on Days Four and Ten; it was negatively correlated on Days Five and Ten; it was positively correlated on Day Seven, Ten and Twenty-Eight, and positively correlated on Days Ten and Twenty-Eight. Altogether there were 9 significant intercorrelations.

Item 2, Response decrement to rattle was positively correlated on Days One and Five and on Days Five and Ten. Altogether there were two significant correlations.

Item 3, Response decrement to bell was positively correlated on Day Two with Days Five and Twenty-Eight. Altogether there were two significant intercorrelations.

Item 4, Response decrement to pinprick was negatively correlated on Days Three and Ten, i.e., only one significant intercorrelation.

Item 5, Response to inanimate visual stimuli was positively correlated on Day One, Two and Four, i.e., two significant intercorrelations.

Item 7, Response to animate visual stimuli was positively correlated on Days One through Ten; it was positively correlated on Days Four, Five and Seven; it was positively correlated on Days Seven and Ten. Altogether there were 8 significant correlations.

Item 8, Response to animate auditory stimuli was positively correlated on Days Five and Seven, i.e., one significant intercorrelation.

Item 9, Response to animate visual and auditory stimuli was positively correlated on Days One, Two, Three and Five. It was also positively correlated on Days Three, Four and Five. Altogether 5 significant intercorrelations.

Item 10, Alterness was positively correlated on Days Three and Four, i.e., one significant intercorrelation.

Item 11, General tonus was positively correlated on Day One, Two, Three, Seven and Ten; it was positively correlated on Days Two, Four, Five, Ten and Twenty-Eight; it was positively correlated on Days Three, Four and Seven; it was positively correlated on Days Seven, Ten and Twenty-Eight and it was positively correlated on Days Ten and Twenty-Eight. Altogether general tonus had the highest number of intercorrelations, (16), and thus exhibited the most consistent pattern over the eight testing days.

Item 12, Motor maturity was positively correlated on Day Four and Twenty-Eight, i.e., only one intercorrelation.

Item 13, Pull to sit was positively correlated on Day Three and Four, i.e., only one intercorrelation.

Item 14, Cuddliness was positively correlated on Days Four and Five, i.e., one intercorrelation.

Item 17, Peak of excitement was positively correlated on Days One and Ten; it was positively correlated on Days Three and Ten and on Days Four and Ten. Altogether there were three intercorrelations.

Item 21, Tremulousness was positively correlated on Days Three and Ten; on Days Four and Ten and on Days Five and Ten. Altogether there were 4 intercorrelations.

Item 23, Lability of skin color was positively correlated on Days One, Two and Three; it was also positively correlated on Days Three and Four, i.e., this item had 3 intercorrelations.

Item 24, Lability of state was positively intercorrelated on Days One. Two, and Seven; it was positively correlated on Days Two and Ten; it was positively correlated on Days Four, Five, Ten and Twenty-Eight; it was positively correlated on Days Five and Ten and on Days Seven and Ten. Altogether it had 8 intercorrelations.

Item 27, Smiling was positively correlated on Day One through Five, Ten and Twenty-Eight; it was positively correlated on Days Two through Seven; it was positively correlated on Days Three, Four, Five and Ten; it was positively correlated on Days Five and Seven. There were altogether 14 intercorreslations, thus this item exhibited a consistent pattern of relation over the eight testing days.

These nine items showed no significant intercorrelation over the testing days. Item 6, Orientation inanimate auditory; Item 15, Defensive movement; Item 16, Consolability; Item 18, Rapidity of build up; Item 19, Irritability; Item 20, Activity; Item 22, Startles; Item 25, Self-quieting activity; and Item 26, Hand-mouth facility.

Only two items, Response decrement to light and Response decrement to pinprick which are both "Habituation" responses, had negative intercorrelations over testing days, that is, inconsistency over the eight testing days.

Intercorrelation of Response to animate visual stimuli and Response to animate visual and auditory stimuli were quite consistent over the first ten days. General tonus, Lability of state and Smiling were even more consistent over Twenty-Eight Days.

B. Each Brazelton Item Correlated With All Other Items

Each item on the scale for each day was correlated with every other item using Pearson r correlation. The matrix of significant intercorrelations was large and the number of significant intercorrelations between items increased over testing with Day Five, Seven and Ten having the highest number of correlations.

Day One had 36 significant correlations.

Day Two had 43 significant correlations.

Day Four had 54 significant correlations.

Day Five had 104 significant correlations.

Day Seven had 95 significant correlations.

Day Ten had 102 significant correlations.

Day Twenty-Eight had 83 significant correlations.

For exact valuses see Appendix F, Tables 1, 2, 3, 4, 5, 6, 7, and 8.

C. Reliability of Overall Scale Over Days

In order to assess scale performance on one day with another, a reliability of two days was figured using an agreement divided by A + D formula in which an agreement was defined as the same score of one adjacent. This was done to compare Day One and Two, Days Two and Three, etc. The results for each subject and for the five drug dosage groups are shown in Table 6. They indicate the absolute level

TABLE 6

SCALE RELIABILITIES BY SUBJECT AND BY GROUPS USING $\frac{A}{A+D}$ FORMULA ONE SCORE ADJACENT

SUBJECT	1-2	2-3	3-4	4-5	5-7	7-10	10-28	1-3	1-4	4-7	4-28	7-28	SUBJECT MEANS
Group 0													
F 28	.55	.37	.52	.26	.48	.54	.39	.45	.20	.37	.35	.30	.40
F 27	.54	.41	.50	.48	.56	.69	.65	.59	.65	.44	.23	.53	.52
F 20	.74	.63	.54	.58	.53	.39	.17	.67	.42	.30	.50	.33	.48
F 18	.38	.58	.74	.40	.50	.26	.47	.48	.37	.63	.45	.29	.46
Means for females													.46
M 17	.43	.70	.48	.41	.79	.83	.67	.48	.61	.54	.37	.62	.58
Means for Group 0	.53	.54	.56	.43	.57	.54	.47	.53	.45	.46	.38	.41	.49
Group I													
F 22	.68	.62	.74	.39	.40	.54	.52	.56	.48	.22	.30	.58	.50
F 21	.59	.59	.37	.63	.41	.44	.52	.37	.37	.52	.52	.54	.49
F 25	.54	.43	.69	.65	.58	.56	.81	.39	.54	.74	.46	.54	.58
F 14	.42	.58	.45	.53	.67			.48	.56	.83	.33	.43	.53
F 8	.44	.52	.37	.38	.55	.64	.67	.52	.50	.30	.33	.64	.49
F 17	.74	.35	.39	.67	.71	.56	.70	.38	.50	.79	.36	.63	.56
F 11	.57	.70	.33	.50	.58	.54	.58	.65	.71	.83	.67	.88	.63
F 3	.54	.62	.62	.56	.33	.64	.40	.69	.58	.38	.32	.48	.51
F 4	.38	.59	.48	.48	.38	.43	.48	.67	.43	.61	.63	.50	.51
F 12	.62	.46	.59	.54	.56	.52	.35	.78	.41	.43	.35	.38	.50
F 2	.48	.54	.74	.61	.39	.56	.45	.78	.52	.45	.73	.52	.56
F 10	.43	.33	.42	.71	.75	.67	.54	.35	.48	.54	.62	1.00	.57
F 5	.54	.61	.65	.62	.69	.35	.56	.52	.50	.39	.41	.38	.52
Means for females													.53

TABLE 6 (continued)

SUBJECT	1-2	2-3	3-4	4-5	5-7	7-10	10-28	1-3	1-4	4-7	4-28	7-28	SUBJECT MEANS
Group I													
M 10	.56	.52	.71	.71	.81	.70	.41	.44	.33	.67	.42	.37	.55
M 9	.50	.49	.65	.50	.68	.58	.86	.53	.37	.50	.50	.52	.56
M 13	.40	.55	.48	.63	.48	.50	.54	.41	.78	.33	.41	.54	.50
M 20		.67	.52	.63	.74					.33	.52	.40	.54
M 3	.42	.50	.41	.57	.24	.46	.54	.45	.38	.33	.46	.29	.42
M 18	.63	.67	.34	.29	.48	.59	.39	.56	.46	.71	.55	.56	.52
M 1	.50	.81	.46	.27	.44	.65	.60	.50	.70	.56	.55	.42	.54
Mean for males													.52
Means for Group I	.53	.56	.52	.54	.54	.55	.55	.53	.51	.52	.46	.53	.53
Group II													
F 16	.58	.54	.37	.46			.33	.48	.67		.46		.49
F 24	.82	.77	.46	.62	.44	.39	.69	.63	.43	.54	.29	.37	.54
F 15	.55	.33	.55	.71	.62	.44	.58	.48	.52	.41	.64	.45	.53
Mean for females													.49
M 11	.37	.48	.87	.73	.73	.75	.46	.55	.58	.70	.41	.67	.61
M 16	.63	.31	.45	.87	.42	.43	.57	.62	.46	.46	.33	.24	.49
M 14	.30	.67	.44	.52	.67	.59	.54	.22	.63	.59	.42	.50	.51
Mean for males													.54
Means for Group II	.54	.52	.54	.65	.58	.52	.55	.51	.55	.54	.43	.45	.53
Group III													
M 8	.54	.81	.42	.58	.38	.73	.71	.58	.50	.54	.37	.75	.58
M 19	.55	.40	.40	.43	.48	.67	.67	.47	.52	.59	.50	.71	.53

TABLE 6 (continued)

SUBJECT	1-2	2-3	3-4	4-5	5-7	7-10	10-28	1-3	1-4	4-7	4-28	7-28	SUBJECT MEANS
Group III													
M 5	.41	.59	.63	.62	.50	.58	.50	.41	.52	.58	.54	.18	.50
M 6	.60	.48	.64	.52	.67	.71	.52	.64	.61	.52	.43	.69	.59
Means of Group III	.53	.57	.52	.54	.51	.67	.60	.53	.54	.56	.46	.58	.55
Group IV													
F 26	.61	.62	.63	.48	.46	.50	.62	.52	.37	.12	.33	.58	.49
F 1	.81	.38	.92	.58	.81	.58	.45	.35	.40	.50	.50	.48	.56
F 13	.39	.54	.50	.35	.46	.48	.42	.43	.30	.52	.33	.41	.43
F 2	.54	.35	.55	.48	.38	.65	.35	.48	.55	.50	.50	.40	.48
F 6	.65	.62	.68	.41	.70	.50	.68	.50	.48	.55	.73	.36	.57
F 7	.42	.56	.54	.57	.39	.39	.35	.38	.59	.36	.24	.44	.43
Mean for females													.49
M 4	.42	.41	.58	.55	.31	.61	.74	.46	.39	.52	.43	.39	.48
M 2	.52	.32	.35	.39	.78	.74	.46	.36	.44	.57	.50	.57	.50
M 7	.50	.41	.54	.61	.55	.58	.58	.50	.64	.50	.65	.33	.53
Mean for males													.50
Means for Group IV	.54	.47	.59	.49	.54	.55	.51	.44	.46	.46	.47	.44	.50

Overall Male reliability mean is .54
Overall Females reliability mean is .49 .

of reliability which was found to be in the 50% and 60%.

However, when a less stringent measure is used, i.e., reliability over days is assessed by using the same score but two adjacent (e.g. score 1 and score 3), test reliability increases to the 70% and 80% level (see Appendix E, Table 9).

This is a conservative evaluation because performance on items is expected to change over days usually [illegible]g upward as the infants' behavior becomes more organized. Th[illegible]c analysis reflects some of this.

4. Factor Analysis

The next step was factor analysis using Principal Components Factor Analyses followed by a Normal Varimax Rotation. Rotating the number of factors determined the Kaiser Criteria (i.e., how big a factor has to be before it can be included), a rule for determining how many factors to rotate. The full factor loadings for each day are shown in Tables 1, 2, 3, 4, 5, 6, 7, and 8 in Appendix F. Table 7 shows the items loaded onto each factor each day. On Day One, ten factors were identified; but then the number declined to nine on Day Two; eight on Day Three, nine on Day Four, eight on Day Five, nine on Day Seven, eight on Day Ten and finally the number of factors declined to seven on Day Twenty-Eight. Several of the clusters of items that make the factors could be classified under a subheading. The first and most consistent factor across days are items 5, 6, 7, 8, 9 and 10. Each of these measures responsiveness to visual and auditory stimuli with item 10 being a dimension of General Alertness. This factor can be called Orientation Responsiveness. On the intercorrelation matrices,

TABLE 7

ITEMS IDENTIFIED ON FACTORS FOR EACH DAY

DAY 1

Factor I	Factor II	Factor III	Factor IV	Factor V
Orient. inan. vis.	Peak excitement	General Tonus	Habit. rattle	Motor maturity
Orient. inan. aud.	Rapid bldup	Pull to sit	Habit. bell	Self-quieting
Orient. an. vis.	Irritability	Activity	Defen. movement	
Orient. an. aud.	Lability of state			
Orient. an. vis. & aud.				
Alertness				

Factor VI	Factor VII	Factor VIII	Factor IX	Factor X
Cuddliness	Habit. light	Rapidity bldup	Pinprick	Peak Excitement
Startles	Consol.	Hand-mouth facility	Activity	Self-quieting
Self-quieting			Tremul.	
			Startle	

DAY 4

Factor I	Factor II	Factor III	Factor IV	Factor V
Orient. inan. vis.	Consolability	Motor maturity	Habit. light	Consolability
Orient. inan. aud.	Rapid. bldup	Labil. State	Habit. rattle	Labil. skin color
Orient. an. vis.	Irritability	Hand-mouth	Habit. bell	
Orient. an. aud.	Labil. State		Self-quieting	
Orient. an. vis. & aud.	Smiles			
Alertness				
Gen. Ton.				

TABLE 7 (continued)

(DAY 4 continued)

Factor VI	Factor VII	Factor VIII	Factor IX
Cuddliness	General Tonus	Pull to sit	Pinprick
Activity	Pull to sit	Tremul.	Orient. inan. vis.
Hand-mouth	Def. movement	Startle	
	Self-quieting		

DAY 7

Factor I	Factor II	Factor III	Factor IV	Factor V	Factor VI
Orient. inan. vis.	Gen. Tonus	Habit. light	Cuddliness	Pull to sit	Orient. inan. aud.
Orient. an. vis.	Def. mov.	Habit. rattle	Hand-mouth	Self-quieting	Tremul.
Orient. an. aud.	Consolability	Habit. bell	Smiles	Smiles	Startle
Orient. an. vis. & aud.	Peak excitement	Pinprick			
Alertness	Rapid. bldup				
Gen. Tonus	Irritability				
	Lability skin				
	Lability state				

Factor VII	Factor VIII
Cuddliness	Pinprick
	Motor maturity
	Lability skin

TABLE 7 (continued)

DAY 28

Factor I	Factor II	Factor III	Factor IV	Factor V
Orient. inan. vis.	Consolability	Habit. light	Gen. Tonus	Pinprick
Orient. inan. aud.	Peak excitement	Habit. rattle	Irritability	Cuddliness
Orient. an. vis.	Rapid bldup	Habit. bell	Self-quieting	Tremul.
Orient. an aud.	Irritability		Hand-mouth	Self-quieting
Orient. an. vis. & aud.	Labil. skin color		Smiles	
Alertness	Labil. state			
Def. mov.				

Factor VI	Factor VIII
Tremul.	Gen. Tonus
	Motor maturity
	Pull to sit
	Defensive movement
	Peak of excitement
	Activity

these items were all highly correlated. Other items load into this factor on different days with the most frequent additions being Item 15, Defensive movement.

A second factor that emerges with less stability across days consists of Items 17, 18, 19, and 24. These are: Peak of excitement, Rapidity of build up, Irritability and Lability of state. This cluster could be names Excitability factor. Item 16, Consolability, frequently joins this factor but in opposite direction.

Another factor consists of the first three items: Response decrement to light, rattle and bell, with Item 4. Response decrement to pinprick, joining very frequently, are all "habituation" measures.

A third factor consists of Item 26, Self-quieting activity, Item 26, Hand-mouth facility, though less consistently, tend to appear with Item 27, Smiling and/or with Item 14, Cuddliness. These reflect activities initiated by the infant which in turn may enable the infant to achieve some state control and therefore be called so.

Another factor which seems to emerge more clearly on the Tenth and Twenty-Eighth day, is composed of Items 11, 12, 13, 14, 20, with 15 joining only on Day Twenty-Eight. (General Tonus, Motor maturity, Pull to sit, Activity, Defensive movement) may be called Motor Organization.

The organization of these behavioral patterns appear more unified at four weeks with seven factors identified with Responsiveness, Extability, Habituation and State control being four of these seven. Startle and Tremulousness are two items that appear as single factors as late as Day Ten and Day Twenty-Eight, respectively.

5. Correlation Between Obstetrical Medications and Behavioral Patterns Measured by Brazelton Scale

A. Analysis of relations between single drugs and drug groups to single "marker" (criterion) items.

Drugs used in this study for the relief of pain in labor and delivery were divided into seven groups with each drug coded within its group (see Appendix G, Table 1):

1. Local and Regional Anesthetics
2. Tranquilizers ("major" and "minor")
3. Narcotic Analgesics
4. Barbiturates
5. Inhalation general anesthetics
6. Scopolamine (used as analgesia potentiating agent)
7. Muscle relaxant (used as adjuvant in general anesthesia)

Individual drugs were rated as follows: 0 - if not igven to a particular subject, 1 - if one basic does was used, 2 - if two basic doses were used, etc. "Basic dose" was considered an amount commonly adminfstered in a single dose (e.g., 10 mgs. of Morphine). Because of the clustering of behavior items into factors, which seem to reflect discrete functional patterns, we found it more meaningful to correlate each drug and each group of drugs with a factor, rather than with each item separately. Therefore, for four of the test days (Day One, Four, Seven, and Twenty-Eight) one item from each factor was chosen as a "marker" item. These items are starred on Table 7. For instance, on Day One, Item 9, Orientation to visual and auditory stimuli, was picked from the first factor as the "marker" item for this factor and for this factor Item 9 was used as a "marker" or criteria item for each of the four test days in the analyses. Since on Day One there were ten factors -- there were ten marker items; Day Four there were nine factors and nine marker items were chosen. Similarly, on Days Seven and Twenty-Eight. Altogether 12 marker items were related to whether or not the infant's mother received a particular drug weighted for the dosage. Exact values are shown in Table 8.

In summary, eleven different drugs were found to be significantly related to four cirteria items on Day One and fourteen to six different criteria items on Day Four; ten drugs were related to seven different criteria items on Day Seven; and five different drugs were related to four different criteria items on Day Twenty-Eight.

While the pattern of effect is not always consistent, some interesting consistencies emerge and will be discussed in the next chapter. Marker items showing significant relations were:

Marker Item 3 - Response decrement to bell ("Habituation") was positively correlated with local anesthesia (pedineal) on Day Four. It had a very high negative correlation with Diazepam on both Days Four and Twenty-Eight. Item 3 (Habituation") had a high negative correlation with secobarbital and with the whole group of barbiturates on Day Four. It was negatively correlated with general anesthesia and negatively correlated with all drugs on Day Four.

In other words, infants whose mothers received local anesthesia habituated faster to visual and auditory stimuli in contrast to infants whose mothers received Valium or barbituartes who habituated less rapidly.

Marker Item 4 - Response decrement to pinprick was positively correlated with regional anesthesia (pudendal) on Day Four. It was positively

TABLE 8

PEARSON r CORRELATIONS OF DRUGS AND BRAZELTON ITEMS

DAY	MARKER ITEM Number	Name	SIGNIFICANTLY CORRELATED WITH Code	Name or Type	Correlation
4	3	Response decrement to bell	1.2	Pudendal (regional)	.46**
4			2.2	Diazepam (Valium)	-.32*
28			2.2	Diazepam (Valium)	-.48***
4			Σ 4	Barbiturates	-.47**
4			4.2	Secobarbital	-.44**
4			5.4	Fluothane (general anesthetic)	-.35*
4			Σall	all drug groups	-.47**
4	4	Response decrement to pinprick	1.2	Pudendal (regional)	.35*
7			2.2	Diazepam	.30*
7			5.4	Fluothane	.35*
28			2.5	Promethazine (always with morphine or meperidine)	.36*
23			Σ 2	Tranquilizers	.32*
1	9	Orient. to auditory and visual stimulus	1.2	Pudendal (regional)	.30*
1			Σ 1	All local anesthetics	.30*
28			Σ 1	All local anesthetics	.32*
1			3.2	Nisentil (short acting narcotic)	.30*
7			3.3	Fentanyl Citrate (Innovar)	-.39**
7			5.2	Cyclopropane	-.39**
1			5.3	Methoxyflurane	-.30*
28			5.3	Methoxyflurane	-.32*
1			6.0	Scopolamine	-.38**
1	12	Motor Maturity	2.1	Chlorpormazine	.30*
1			3.2	Nisentil	.30*
1	13	Pull to sit	2.5	Promethazine (Phenegran, tranquilizing antihistamine always given with morphine or meperidine)	-.39**
1	14	Cuddliness	3.3	Innovar (tranquilizer and narcotic	-.54***
1			4.1	Thiopental (barbiturate)	-.47**
1			5.2	Cyclopropane (general anesthetic)	-.54***

TABLE 8 (continued)

	MARKER ITEM		SIGNIFICANTLY CORRELATED WITH		
DAY	Number	Name	Code	Name or Type	Correlation
1	14	Cuddliness	7.0	Anectine (muscle relaxant)	-.47**
7			2.4	Hydroxizine (Atarax)	-.31*
4	15	Defensive Movements	2.2	Diazepam (Valium-tranquilizer)	-.64***
4	18	Rapidity of build up	1.1	Perineal (Local)	-.33*
4			1.2	Pudendal (regional)	.31*
4			2.4	Hydroxizine (Atarax)	.32*
7			1.3	Spinal (regional)	-.31*
7			2.5	Promethazine (always given with narcotic)	-.38**
4	21	Tremulousness	1.1	Local anesthesia (perineal)	.36*
4			5.1	Nitrous Oxide	-.33*
7			3.1	Meperidine	-.32*
28			2 2	Diazepam	.38**
4	23	Lability of skin color	3.3	Fentanyl Citrate + Droperidol (Innovar)	.30*
4			5.2	Cyclopropane	.30*
7	27	Smiling	1.1	Local anesthesia (perineal)	.40**
7			2 7	General anesthesia	-.31*

Drugs 2.5 and 6 were always given in conjunction with drugs 3.1 and 3.4.

$p > 0.05$ = *
$p > 0.01$ = **
$p > 0.001$ = ***

correlated with diazepam and with general anesthesia on Day Seven. It was also positively correlated with a combination of narcotics and potentiators (morphine-promethazine, meperidine-promethazine) and with the group of tranquilizers on Day Twenty-Eight. That is, habituation to a pinprick was faster up to Day Seven in babies whose mothers received local anesthesia, Valium and general anesthesia. Habituation to pinprick was faster in babies whose mothers received combinations of potentiators and narcotics and a group of tranquilizers at the age of one month.

Marker Item 9 - Orientation response to visual and auditory stimuli (Orientation Responsiveness") was positively correlated with regional anesthesia (pudendal) on Day One and with the whole group of local anesthetics both on Day One and Twenty-Eight. Item 9 was positively correlated with alphaprodine (Nisentil), a short acting narcotic, on Day One and negatively correlated with a combination of potentiator and narcotic (fentanyl citrate plus droperidol, "Innovar") on Day Seven. It was also negatively correlated with general anesthetics (cyclopropane) on Day Seven and methoxyflurane on Days One and Twenty-Eight. Item 9 was negatively correlated with another combination of potentiator and narcotic, i.e., scopolamine morphine or scopolamine meperidine on Day One.

In other words, babies whose mothers had received local anesthetics or a short acting narcotic showed higher responsiveness, while babies whose mothers received combinations of narcotics with potentiators (scopolamine or droperidol) or the inhalation anesthetics cyclopropane and methoxyflurane, showed a lower degree of responsiveness.

Marker Item 12 - Motor maturity was positively correlated with a tranquilizer chlorpromazine and with the short acting narcotic alphaprodine (Nisentil) on Day One. In other words, newborns whose mothers received either of those drugs showed a larger range of movements.

Marker Item 13 - Pull to sit was negatively correlated with the combinations of potentiators and narcotics, promethazine-morphine or promethazine-meperidine, on Day One. In other words, these drugs reduced the time the baby could hold his or her head erect.

Marker Item 14 - Cuddliness ("State control" factor) had a very high negative correlation with the combination of potentiator and narcotic Innovar, high negative correlation with Thiopental (injectable barbiturate used for general anesthesia), very high negative correlation with an inhalation general anesthetic (cyclopropane), high negative correlation with a muscle relaxant (Anectine) and negative correlation with a tranquilizer, hydroxizine (Atarax). In other words, newborns whose mothers received any of those drugs had a greater tendency to move and thrash around when held in the examiner's arms.

Marker Item 15 - Defensive movement had a very high negative correlation with the tranquilizer diazepam (Valium), i.e., babies whose mothers had received that drug reacted with a lesser range of movement to a diaper placed on their faces.

Marker Item 18 - Rapidity of build up ("Excitability" factor) was negatively correlated with local anesthetics, i.e., with local (perineal) anesthesia on Day Four, positively correlated with regional anesthesia (pudendal) and with a tranquilizer, hydroxizine (Atarax) on Day Four, and negatively correlated with both spinal anesthesia (regional) and with a combination of potentiator and

and narcotic promethazine-morphine or promethazine-meperidine on Day Seven. In other words, on Day Four babies whose mothers received perineal local anesthesia required more aversive stimuli than other babies before they began to cry, while babies whose mothers received pudendal regional anesthesia or hydroxizine required fewer aversive stimuli. On Day Seven babies whose mothers were treated with spinal anesthesia or the combination of a narcotic with promethazine required more aversive stimuli before beginning to cry.

Marker Item 21 - Tremulousness was positively correlated with local (perineal) on Day Four; negatively correlated with a general anesthetic (nitrous oxide) on Day Four; negatively correlated with meperidine on Day Seven and positively correlated with tranquilizer diazepam (Valium) at the age of one month.

In other words, on Day Four babies whose mothers had perineal anesthesia showed a higher degree of tremor as observed by frequency and extension of the movement, while babies whose mothers had nitrous oxide showed less such movements. Meperidine had a similar suppressing effect on Day Seven, while babies whose mothers had diazepam showed an increase in tremors on Day Twenty-Eight.

Marker Item 23 - Lability of skin color was positively correlated with a combination of potentiator and narcotic (Innovar) and with a general anesthetic (cyclopropane) on Day Four, i.e., in babies whose mothers received those drugs the color of skin would change often and to a greater degree.

Marker Item 27 - Smiling ("State"control" factor) had a high positive correlation with local anesthesia (perineal) and a negative correlation with general inhalation anesthesia as a group on Day Seven, i.e., on that day babies whose mothers had perineal anesthesia would smile with more frequency, while those of mothers with general anesthesia would smile less frequently. Marker Items 16, Consolability and 26, Hand-mouth facility were not significantly related to any of the drugs.

B. Analysis of relationship between obstetrical drugs grouped according to their dosage and Brazelton Items.

Another way of relating drug data to Brazelton Items scores would be by grouping the subjects according to the amounts of drugs their mothers received. Thus, five Drug Dosage Groups were constituted.

Group 0 -	No premedication, perineal only	
Group I - (little medication)	Nisentil	30 mg or less
	Demerol	50 mg or less
Group II - (medium medication)	Nisentil	30-60 mg
	Seconal	60-100 mg
	Demerol	100 mg in 8 hr prior to delivery
Group III - (heavy medication)	More than two of above medication in doses of:	
	Nisentil	60 mg
	Demerol	100 mg or more in 8 hr before delivery
	Seconal	100-180 mg
Group IV -	General Anesthesia (any type)	

Means of each of the 27 Brazelton Items over eight testing days were plotted for each Drug Dosage Group (see Appendix H, graphs). Group IV, General anesthesia had generally the lowest scores on the first four days, i.e., subjects in the General anesthesia group performed less well than the other Drug Dosage Groups.

This finding points in the same directions as Brazelton's findings, i.e., infants whose mothers received General Anesthesia sucked less efficiently (Brazelton, 1961).

The relationship between Drug Dosage Groups and Brazelton Scale scores was further analyzed employing Profile Analysis, i.e., repeated measure analysis of variance. Four marker items were chosen out of the thirty-four factors: 3 - "Habituation;" 4 - "Habituation to pinprick;" 9 - "Orientation Responsivity" and 18 - "Excitability," since these items were represented at all four testing days.

The main effect Drug Dosage Group was found to be significant for marker Item 9 (Orientation Responsivity) but not for the other three. After inspection of means differences (Figure 1) the main effect Drug Dosage Group was found to be: The 0 D.D.G. had the highest mean score on Orientation Responsivity with the exception of D.D.G. III. This D.D.G. is departing from the general trend of lowered mean scores. However, it should be noted that D.D.G. III is the smallest group (4 subjects) and includes no females.

The score of D.D.G. IV, General Anesthesia, is markedly the lowest throughout all four testing days.

These results confirm the results of Pearson r analyses described previously. (For exact mean values see Appendix I).

Summary of Results

Control variables were identified and their relationships to the different States (e.g., sleep, alertness) as well as to the Brazelton Item scores was analyzed. Birth weight was the only control variable found to have significant correlation with some of the Items.

The relationships of the States with Brazelton Scale Items were analyzed and found to be significantly correlated with some of the items. Brazelton Scale items intercorrelations over days yielded a large number of significant correlations.

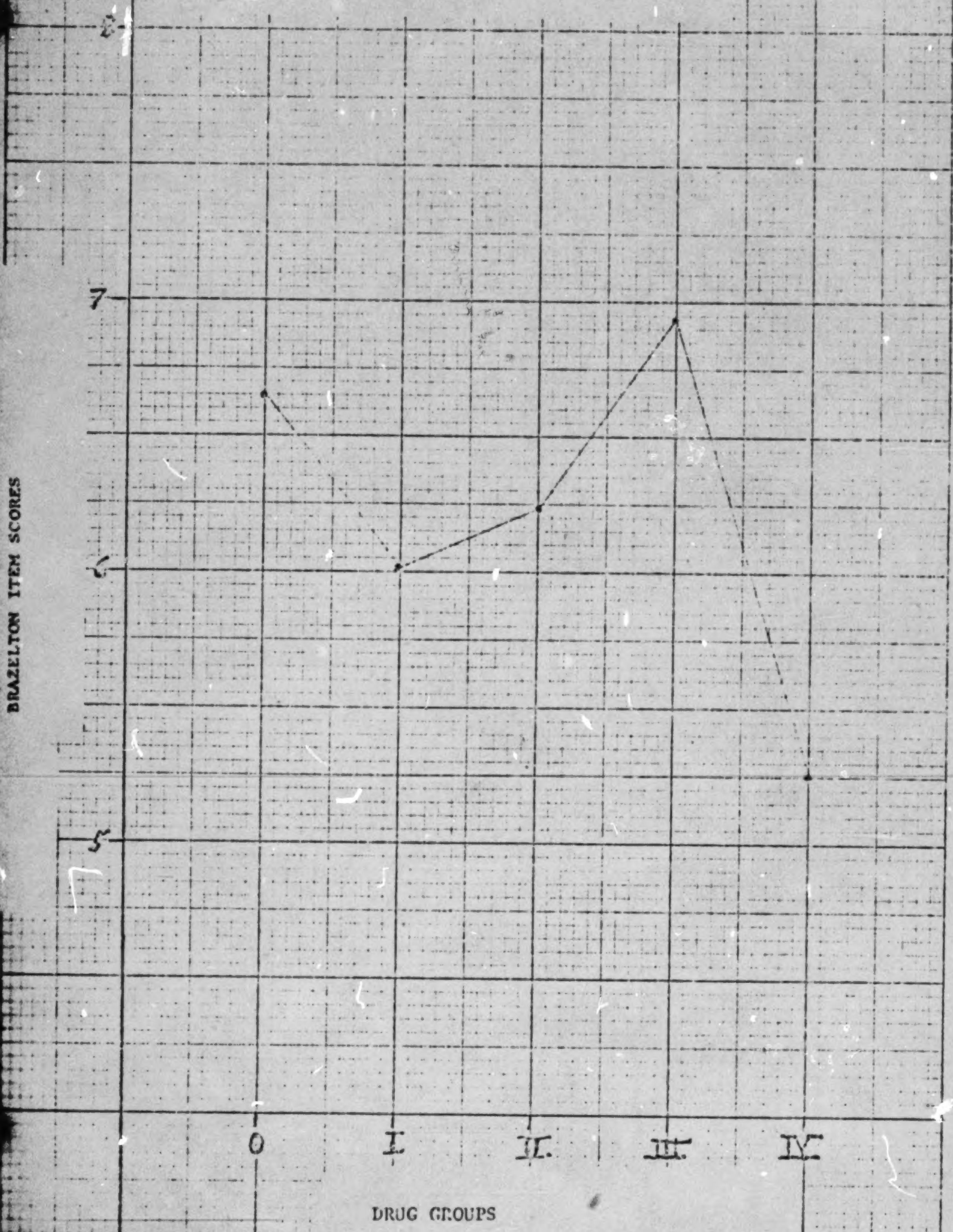
The reliability of the overall scale (over days) was then figured out for males and females. Changes over days were seen usually going upward as the infant's behavior became more organized.

The growing organization of the different behaviors around factors became apparent when factor analysis was applied and the number of factors identified, decreased from 10 on Day One to 7 on Day Twenty-Eight.

The relationships between "marker" items of these factors and the obstetrical medication were analyzed. All drugs were found to have effects on the different behaviors as measured by scale. The most long-lasting effect, i.e., till Day Twenty-Eight, was exerted by inhalation General anesthetics, narcotics and tranquilizers.

The subjects were also divided into drug groups according to dosage and the mean of each Drug Dosage Group was graphed. The General anesthesia group tended to have the lowest mean scores on the Brazelton Scale.

FIGURE 1
Profile Analysis Item 9



CHAPTER IV

DISCUSSION AND CONCLUSIONS

The discussion of results will focus primarily on two topics: (a) the relationships between the different Brazelton Scale Items and their possible implications, and (b) the relationship between obstetrical medication and Brazeltion Scale scores and its implication.

1. Relation between the different Brazelton Scale scores

a. Control variables

With the exception of birth weight, the control variables did not show any pattern of significant correlations with state or Brazeltion Items scores. In other words, sex, race, mother's age, parity and number of children did not in our sample show any persistent effect on infant behavior as measured by the scale. The few isolated high correlations with mother's age and number of living children elude explanation. The birth weight showed a more clear-cut pattern of correlations. It appears, that the heavier babies exhibited less alertness, a lower muscle tone and greater lability of peripheral blood flow and this decreases and disappears within the first four weeks of life.

b. States

The high correlation between Predominant State 1 and Predominant State 2 shows that the babies tended to remain with a relatively narrow range of state, e.g., varying from drowsiness into alertness or from a vigorous movement to crying.

The high negative correlation between Initial State and habituation items deserves discussion. It will be remembered that babies were tested for habituation only if the Initial State fell within the sleep range. Therefore, this high negative correlation implies that deep sleep, i.e., a condition of inhibition in the central nervous system, facilitates habituation. It should be pointed out that habituation is assumed to be a function of the same reticular activating system in the midbrain which controls sleep and wakefulness (Kolb, 1973).

The positive correlation between Predominant State 1 and orientation responses and alertness corresponds to expectations, i.e., a sleepy baby would not be expected to be alert or to show vigorous orientation responsiveness. The same expectations apply to correlations between Predominant State 2 on one hand, and Peak of excitement, Rapidity of build up, Irritability, Lability of state on the other hand. Negative correlations between Predominant State 2 with Self-quieting activity and Smiling is also to be expected, i.e., babies that exhibited a higher amount of crying were less able to quiet themselves and smiling is rarely observed in a baby which is not relaxed.

c. Brazeltion Scale Items intercorrelations and factor loading

Two patterns emerged from the statistical analyses, namely, the high number of significant item correlations and the clustering of items around a common factor.

The correlations between the items (some of them in the .90 and .80) increased in number over testing days. This possibly reflects the increasing organization of the infant's behavior. The trend toward increasing organization over the first four weeks is also reflected in the decrease in the number of factors from ten on Day One to seven at one month.

The most stable factor involves items measuring Orientation responsiveness to auditory and visual stimuli in conjunction with

Alertness. Item 15, Defensive movement, sometimes loads into this factor.

The second factor which might be named "Excitability" may be assumed to be related to a diffuse excitatory state of the central nervous system, while the previous factor, Orientation responsiveness seems to be related to activation of specific structures in the central nervous system. That may explain why Defensive movement, which is a discrete rather than a diffuse behavior, joins with the first factor even though it is a response to an aversive stimulus.

The third factor, "Habituation" represents inhibition of response to a repetitive stimuli which seems to be a rudimentary important adaptive mechanism to environmental input.

The next factor is "State control" or control of internal environment, as opposed to adaptation to external environment, represented by Orientation responsiveness and "Habituation."

Another factor which appears on the Tenth and Twenty-Eighth day is "Motor organization." The shift of Item 15, Defensive movement, into this factor at age of one month may reflect the increasing organization of mobility which makes motor functions more closely correlated. The fact that Defensive movement appears first in conjunction with responsiveness to environmental stimuli ("Orientation responsiveness") and later in relation to "Motor organization," may be explained by its being biologically very important for survival, i.e., an infant who can not get rid of an object lightly covering his face has less chance of survival.

Startle and Tremulousness appear as isolated factors Days Ten and Twenty-Eight, respectively. The latter is related to drug data and will be discussed in that context.

The fact that Brazelton Scale Items load into factors, as outlined above, implies the presence of redundancy in the test, i.e., that some items measure behaviors which are not independent variables (Horowitz, et. al., 1973). Eliminating the items loading into a common factor will not necessarily improve the text, though it might shorten it. However, the redundancy may present some definite advantages:

(a) repeated assessment of related behaviors in a variety of ways may add to the stability of the test and may have contributed materially to the high reliability of scoring and factor stability;

(b) a consistent shift with age of an item from one factor to another may indicate a change in behavior organization,

> "At the individual diagnostic level there is also an interesting possibility. If an individual infant shows discrepancy in scoring on items that within the general population are highly correlated a misalignment of response integration could be identified and may turn out to be at the base of some cases of so-called learning disability - especially where one channel of information processing that is typically related to another is widely divergent within a particular infant." (Horowitz, et. al., 1973)

2. Discussion of Drug Effects

This study had to be carried out in a clinical setting in which the deliveries were performed according to accepted medical standards and therefore it was not possible to control the sample intake. Thus the sample included only five (about 11%) subjects receiving no drugs at all and most subjects received several drugs. Thus when a drug was correlated with a higher score of behavior, it did not necessarily mean that it induced a higher level of functioning. The effect may have been due to the fact that a more potent or more long-lasting alternative drug was not used. For instance, the substitution of the short-acting narcotic, alphaprodine, for standard narcotics resulted in higher levels of functioning. For intercorrelations of drugs grouped by type, see Appendix G, Table 2. Some drugs have a synergistic (or potentiary) effect when given together, as exemplified by promethazine added to a narcotic. Moreover, when several drugs are administered in different combinations to a number of subjects, the overlapping of drug effects may mask the differences for a while, until the drugs become separated by differential rate of elimination. This may be the reason why the pattern of drug effects was not always consistent (e.g., certain effects were significant on some days and not on others), yet certain clear-cut patterns emerged in a convincing manner. These relate to the following:

A. Seven drug groups comprised of twenty-six individual drugs

a. Local anesthetics

Local anesthetics were generally correlated with higher level of functioning, as reflected on Day One by significantly higher scores on Orientation, Habituation to sensory stimuli and to pinprick and on Day Seven on Smiling. In regard to Orientation the effect persisted till Day Twenty-Eight. This corresponds to the fact that patients receive local anesthetics in order to reduce or avoid the use of drugs depressing the CNS and, indeed, the local anesthetics as a group showed a high negative correlation with general anesthetics, with the muscle relaxant succinilcholine (which is a drug used only in patients under-going general anesthesia) (Goodman and Gilman, 1970), and with scopolamine (which was administered in this study always in conjunction with a narcotic (see Table 9). Local anesthetics also showed a trend (i.e., $p > 0.05$) to negative correlation with barbiturates and narcotics (see Table 8).

TABLE 9

Distribution of Narcotics and Narcotic Potentiators Across Subjects

Subject #	Narcotics meperidine 3.1	alphaprodine 3.2	morphine 3.4	Potentiators chlorpromazine 2.1	promethazine 2.5	scopolamine 6.
F1	X	0	0	0	0	0
F2	X	0	0	0	X	0
F3	X	0	0	0	X	0
F4	X	0	0	0	0	0
F5	X	0	0	0	X	0
F6	X	0	0	0	0	X
F7	X	0	0	0	0	X
F8	X	0	0	0	X	0
F9	X	0	0	0	0	X
F10	0	0	X	0	0	X
F11	X	0	0	0	X	0
F12	X	0	0	0	X	0
F13	X	0	0	0	0	X
F14	X	0	0	0	X	0
F15	X	0	0	0	0	X
F16	0	X	0	0	0	0
F17	0	X	0	0	0	0
F18	0	0	0	0	0	0
F21	X	0	0	0	0	X
F22	X	0	0	0	X	0
F24	0	X	0	0	0	0
F25	X	0	0	0	0	0
F26	X	0	0	0	0	X
F27	0	0	0	0	0	0
F29	0	0	0	0	0	0
F30	0	0	0	0	0	0
[illegible]	X	0	0	0	X	0
[illegible]	X	0	0	0	X	X
[illegible]	X	0	0	0	X	0
[illegible]	X	0	0	0	0	X
[illegible]	X	0	0	0	0	0
[illegible]	0	X	0	X	0	0
[illegible]	0	0	0	0	0	0
[illegible]	0	0	X	0	0	X
[illegible]	X	0	0	0	0	0
[illegible]	X	0	0	0	0	0
[illegible]	0	0	X	0	0	X
[illegible]	X	0	0	0	X	0
[illegible]	0	0	X	0	0	X
[illegible]	0	X	0	0	0	0
[illegible]	0	0	0	0	0	0
[illegible]	X	0	0	0	0	0
[illegible]	0	X	0	0	0	0
[illegible]	X	0	0	0	0	0

With local anesthetics, Tremulousness was increased on Day Four, i.e., the other drugs probably have suppressing effects. We do not know whether this is favorable to the infant, as we do not know whether Tremulousness is simply a sign of CNS immaturity or an adaptive mechanism, e.g., helping to maintain body temperature like chills in the older organism.

The correlation of local anesthetics with Rapidity of build up showed an inconsistent pattern (decreased by perineal and spinal and increased by pudendal).

b. Tranquilizers

Diazepam (Valium) showed an interesting pattern of correlations as it appears to have decreased behavior evoked by aversive stimuli: a pronounced lowering of Defnesive movement (Day Four) and in increase in Habituation to Pinprick (Day Seven). At the same time diazepam was correlated with decrease in Habituation to sensory stimuli (non-aversive) on Days One and Twenty-Eight. Such effects correspond to pharmacological action of diazepam which is considered an "anti-anxiety" drug but also a mild sedative (i.e., has a general CNS depressant effect). We know that sedatives decrease habituation (see below), but the effect of diazepam seems more persistent (four weeks). The effects of chlorpromazine on Motor maturity and of hydroxyzine (Atarax) on Cuddliness and Rapidity of build up are more difficult to understand. Promethazine is chemically and pharmacologically related to tranquilizers, but in this sample it was used exclusively as potentiator of narcotics (see Table 9) and its effects are so closely related to other narcotic potentiating drugs (scopolamine, droperidol) that they will be discussed jointly with the narcotics. It is worthwhile mentioning that some effects of diazepam and of tranquilizers as a group could be observed at four weeks.

The correlation between increase in Tremulousness on Day Twenty-Eight and tranquilizers as a group is not easily understood, as we do not know enough about the physiological mechanism of that phenomenon, but it is evident that some effects of some drugs appear to persist for four weeks at least.

c. Narcotic analgesics

These drugs had a pronounced and consistent depressing effect on several behaviors: Orientation, Pull to sit, Cuddliness and regulation of circulation (indicated by Lability of skin color). More significantly, the potentiating drugs, promethazine and scopolamine, as well as the synergistic combination fentanyl-droperidol (Innovar) were clearly implicated in the depressing effect. In addition, the short-acting narcotic alphaprodine (Nisentil) was significantly correlated with higher scores on Motor maturity and on Orientation as early as Day One, indicating that rapidity of elimination may be a critical factor. At the other end of the spectrum, Innovar was correlated with higher Lability of skin color as late as 28 days.

d. Barbiturates

In this study barbiturates showed only two significant correlations: decrease in Habituation (secobarbital) and in Cuddliness (thiopental) both on the first day.

e. Inhalation anesthetics

These drugs had a broad depressing effect manifested by a decrease in Orientation (Days One and Seven), in Cuddliness (Day One), Smiling (Day Seven) and increased Lability of skin color (i.e., impaired control of peripheral circulation). The decrease in Tremulousness (Day Four) may be due to depressed CNS function. The habituation to

Pinprick was increased on the Seventh day. Habituation, which involves deactivation of a cortical function is probably an inhibiting function of the reticular activating system (RAS) (Kolb, 1973; Goodman and Gilman, 1970). All hypnotics and general anesthetics must affect the RAS in order to abolish wakefulness, but small doses of such drugs may interfere selectively with the inhibiting functions of RAS only (Goodman and Gilman, 1970, p. 24), thus accounting for decrease in habituation to sensory stimuli in general. Habituation to Pinprick, however, involves specifically de-activation of reaction to pain and inhalation anesthetics reduce the reaction to pain and thus may increase habituation to painful stimuli. Thus the two types of habituation, to Pinprick on one hand and to visual and auditory stimuli on the other, are not functionally identical and this explains their very low factor loading and their different response to drugs.

Inhalation anesthetics are rapidly eliminated (see Appendix A) and it is generally assumed that their effects are brief. The results of this study indicate that this should not be taken for granted. Many effects were seen on the seventh day and methoxyflurane (which is known for its relatively more prolonged action) was significantly correlated with decreased orientation on the Twenty-Eighth day.

f. Other drugs

Scopolamine was discussed jointly with narcotics while succinilcholine showed only one negative correlation with Cuddliness, on Day One. This corresponds to expectations, since succinil-choline is a short-acting drug, affecting the muscular system, but showing no appreciable clinical effects on the CNS.

Comparing the effects of the different drug groups it becomes apparent that the two groups, inhalation anesthetics and narcotics, had the most effects. These two kinds of drugs appear with high frequency in the sample (twenty-five subjects had one or more inhalation anesthetic and thirty-eight out of forty-four subjects received a narcotic of one type or another). These two drug groups with local anesthetics form, indeed, the basis for relief of pain. Sedatives and tranquilizers were used less consistently and mainly as adjunctive medication -- some of the latter also as potentiators.

B. Five Drug Dosage Groups

The graphs of the five Drug Dosage Groups indicate that the general anesthesia groups tended to have lower mean scores over the first four days, a finding which points in the same direction as Brazelton's study (Brazelton, 1961).

The effects of drugs are commonly divided into main pharmacologic effects (usually the desired one), side-effects (often related to the main effect, but undesirable) and toxic, un-toward reactions. A survey of the data of this study shows that most of the effects of the drugs on the infant are closely related to its main pharmacologic effects. In other words, the more effective the drug for the mother the more effect it is apt to have on the newborn. This situation is exemplified by the far-reaching effects on the newborn of such excellent narcotic potentiators as scopolamine, promethazine or droperidol. Another finding of this study is that some effects of drugs can be demonstrated even at four weeks of age, as had been found also by Conway and Brackbill (1970). The pain-relieving effects of anesthetics and analgesics lasts for a few hours at most, but it is becoming gradually recognized that other effects of these drugs may persist much longer, even though the

the drug has all but disappeared from the blood. It is assumed that some drugs, or their metabolic products, remain attached to tissues, possibly bound to a protein and continue to exert effects (Goodman and Gilman, 1970).

This study seems to confirm in a more detailed and systematic way the findings of previous research (see Appendix A). Much of the earlier research was directed at the severe respiratory and circulatory depression with its concommitant danger to life and hence the investigators were relying principally on the Apgar Score. Brazelton (1970), however, pointed out that satisfactory condition at birth was no assurrance of freedom from later, drug induced, complications, such as decreased responsiveness and motor activity, or inadequate peripheral circulation and inability to clear mucus from the airways. Several studies on isolated behavior patterns produced evidence to support the hypothesis that drugs affect neonatal behavior for several weeks, and possibly longer. Thus Borgstedt and Rosen (1968) found in a controlled study that meperidine, promethazine and phenobarbital are related to a decrease in alertness and reactivity accompanied by changes in EEG, while Brazelton (1961, II) and Kron (1966) in independent studies found delay and impairment of sucking behavior correlated to maternal medication. Emde and Koening (1969, a, b) found significant decrease of smiling behavior in infants whose mothers had depressant medication, as early as eight hours before delivery, while Stechler (1964) found a decrease of visual attentiveness in the first four days correlated with the amount of analgesics and hyponotics. Conway and Brackbill found a significant impairment of habituation to an auditory stimulus at the age of one month, as well as decrease in muscle tone in the first week.

Ashton (in preparation) found out, in a group of 92 Uruguayan newborns that Orientation to animate visual and auditory stimuii (human face and voice) was significantly higher than to inanimate ones. The Kansas study showed no such difference, a finding which may be explained by genetic population differences or by the fact that the majority of Uruguayan mothers had no medication (Ashton, in preparation). If the drugs do affect the newborn's ability to respond differently to human and to inanimate stimuli, this may leave far reaching consequences. Klaus, et al. (1970) described how behavior of mothers is affected by the neonate's response, and specifically eye-to-eye contact. Thus orientation, consolability or irritability (which is the reverse of rapidity of build up) form an integral part of a complex pattern of reciprocal reinforcement occuring between the newborn and the caretaker, a pattern which provides the matrix of the child's early social behavior. The extent to which obstetrical medication interferes with child-parent interaction and with early, critical stages of learning, is yet a matter of speculation, but the evidence produced so far indicates that this is a definite possibility which should be taken into consideration in deciding on the indication for the choice of pain-relieving drugs in labor and delivery.

Suggestions for Future Research

This study is part of a large project currently in progress at the Infant Laboratory of the Department of Human Development and Family Life at the University of Kansas. In the initial stage, Self (1971) studied the looking behavior of infants at the age of 6 weeks and related it to their behavior at the age of 3 days as measured by the Brazelton Scale. J. Ashton (1972) studies the behavior of Uruguayan infants (ages 2 to 4 days) measured by the Brazelton Scale. Seventy percent of these infants were drug free. The present study represents a further step in studying infant behavior by use of the Brazelton Scale and identifying the variables involved in its assessment.

The next steps to be undertaken will involve the following:

1. A follow-up of this sample (e.g., using the Bayley Scale) to find out (a) whether the correlations between Brazelton items are continued by analogous patterns at a later age, (b) whether drug effects persist beyond four weeks.

2. Comparative studies on babies from different countries and similar to Ashton's study (1972) are needed, since it is extremely difficult to obtain, in the United States, a large sample of drug-free newborns. Kraemer, Korner and Thoman (1972) suggested that the length of labor influences neonatal behavior. Since almost all of their subjects had drugs and drugs may prolong labor, as well as influence behavior, that study should be replicated on drug-free subjects.

3. There are clinical problems at infancy, due to unknown cause, e.g., the so-called "three month colic." By correlating the symptoms of such cases with history of obstetrical medication one might be able to find evidence to indicate that some of these cases are related to pain-relieving drugs administered during labor and delivery.

SUMMARY

The behavior of forty-four newborns, eighteen males, and twenty-six females was studied over one month employing Brazelton Infant Assessment Scale. The results were analyzed in two ways, (a) consistencies and changes as well as organization over the first month ranging from the first day to one month, (b) relation between behavior patterns of newborns and drugs given to their mothers during labor and delivery, for the relief of pain. General anesthesia was included among these drugs. Results indicated consistent patterns of behavior with increased organization of behaviors such as Orientation responsiveness, Habituation, Excitability, and Motor organization towards the end of the first month of life. The above behavior seems to be affected by the obstetrical drugs and some of the effects still persist at the age of one month. The different results are discussed and some suggestions for future research are offered.

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APPENDIX A

I. Obstetrical Medication

1. Classification, dosage and routes of administration of obstetric anesthetics and analgesics[1]

Drugs used for the relief of pain are generally classified according to their major effect, with the understanding that some drugs produce different effects according to dose and route of administration (Bowes, 1970; Davis and Rubin, 1966).

A. General anesthetics

When given in sufficient dosages, general anesthetics will produce a state of unconsciousness with loss of sensation (i.e., anesthesia) that allows any surgical procedure to be carried out, though by themselves they are not pain killers. Anesthesia results from the pronounced functional depression of the CNS. The most commonly used obstetric anesthetics are the inhalation anesthetics, i.e., gases (e.g., nitrous oxide, ethylene, cyclopropane) or volatile liquids (e.g., ether, halothane, methoxyflurane, trichloroethylene). Chloroform, a potent volatile anesthetic, is hardly ever used in obstetrics because of its dangerous side effects. Volatile liquids can be dropped on a mask held over the patient's face, but more frequently the inhalational anesthetics are administered by means of more or less elaborate breathing apparatus which provides a well controlled mixture of gas (or vapor) and oxygen and absorbs carbon dioxide exhaled by the patient. Inhalation anesthetics generally produce a rapid effect upon administration; upon withdrawal, rapid recovery usually results. Recovery typically occurs within minutes. Methoxyflurane has the longest recovery period (30-60 minutes).

General anesthesia can also be produced by high doses of sedatives. The method commonly employed consists of intravenous injection of an ultra-short acting barbiturate (e.g., thiopental in doses from 0.12 gm. up to 1.0 gm.). Intravenous anesthesia has the advantage of rapid, smooth onset with few complications and side effects. On the other hand, barbiturates do not relieve pain, unless administered in doses causing loss of consciousness, so that pain-relieving drugs usually have to be added to provide for post-operative analgesia.

General anesthetics used during the birth process are generally of the inhalation kind. They are nearly always administered at the end of the second stage (i.e., just before expulsion of fetus) though smaller doses of inhalation anesthesia ("whiffs") are commonly used to relieve pains of contractions. Intravenous barbiturate anesthesia is not often used in obstetrics (except for cesarean section) because the recovery is much slower than with inhalation anesthetics.

Other depressants of the CNS, such as alcohol are not used for obstetric purposes. These depressants will, therefore, not be reviewed here.

B. Sedatives

Calm, drowsiness, or sleep (i.e., hypnotic effect) can be induced by sedatives. They do not induce loss of consciousness (i.e., general anesthesia) when administered in usual doses, although high doses of some sedatives may be used to produce general anesthesia, e.g., thiopental. Sedatives, like general anesthetics, depress the CNS. The most commonly used sedatives are the barbiturates, usually classified according to time it takes to produce the desired effect and the duration of its effect (ultra-short, short, medium and long acting). Barbiturates are typically administered orally. Sodium phenobarbital, a long-acting barbiturate, can be injected intra-mulcularly, and is often used pre-operatively in obstetrics for that purpose. (It is also commonly used in the control of convulsions.) The ultra-short acting compounds (e.g., thiopental) are usually administered intravenously for rapid effect. Barbiturates are typically administered in doses varying from 100 mg. to 250 mg. Other sedatives include chloral hydrate, a relatively non-toxic substance (0.25 gm. to 1.0 gm.), ethchlorvynol (Placidyl) (0.1 gm. to 0.5 gm.), and glutethimide (0.25 gm. to 0.5 gm.) (Goodman and Gilman, 1970).

C. Analgesics and Narcotics

Analgesics (including narcotics) selectively reduce the sensation of pain while producing only minor effects on alertness, as opposed to the action of anesthetics (inhalation anesthetics and barbiturates). Narcotic analgesics comprise the opium alcaloids (e.g., morphine and codeine) and their synthetic analogues, (meperidine, methadone, levorphanol). When these are given in heavy doses, they can also produce drowsiness and have calming effects similar to barbiturates.

Narcotics act by depressing the functions of the CNS, although the depressing influence is different from general anesthetics. Narcotics have selective rather than general effects. For example, the principal effects of morphine are: (a) suppression of pain; (b) mild drowsiness and euphoria; (c) depression of respiration; (d) nausea and sometimes vomiting; (e) constipation (Goodman and Gilman, 1970). The "withdrawal syndrome" is characterized by irritability, tremor, increased heart rate and blood pressure, lacrimation, sweating, nasal discharge, diarrhea and, occasionally, vomiting. Other narcotics produce similar therapeutic effects and have similar withdrawal syndromes with prolonged use.

Narcotics are most commonly employed in early stages of labor to relieve pain, but may also be used in conjunction with anesthetics. Morphine is usually administered by intramuscular injections of 10 mg. to 20 mg. The most commonly used obstetric narcotic is meperidine, which is injected intramuscular in doses of 50 mg. to 100 mg.

D. Tranquilizers

Tranquilizers are drugs that produce a calming effect, without affecting alertness or inducing sleep. They do not depress CNS function when administered in typical doses. Their main effect consists of reducing the intensity of emotional reactions. Numerous tranquilizers are on the market and they are probably among the most widely prescribed medications in general use. They are divided into two main classes: (a) "major" tranquilizers (e.g., phenothiazines, rauwolfias, butypherones) have profound effects and are used mainly in psychiatry; (b) "minor" tranquilizers (e.g., benzodiazepines, meprobamate) mainly reduce anxiety and have a very wide field of application.

There are two "major" tranquilizers that are often used in obstetrics. The first is chlorpromazine. It is given in doses of 50 mg. to 100 mg. intramuscularly. It is often used for its potentiating effect on general anesthetics and analgesics that allows a smaller dose of the other drug to produce the desired effect. The tranquilizing influence is merely a beneficial side effect. Prometazine, a related compound, is used for the same purpose. The second major tranquilizer used in obstetrics is reserpine, an alcaloid of the rauwolfia group. It is given in doses of 2 mg. to 4 mg. Like other rauwolfia preparations, it lowers the blood pressure while also producing a tranquilizing effect. Rauwolfia is sometimes used in late stages of pregnancy though some authors object to such use (Ban, 1969). It appears that some infants are born with effects of this medication (to be discussed below).

The two minor tranquilizers most commonly used in obstetrics are chlordiazepoxide (Librium) in doses of 10 mg. to 25 mg., and diazepam (Valium) in doses of 5 mg. to 10 mg. They are both administered to reduce anxiety and the latter has also a muscle-relaxing effect. Diazepam is also used to control convulsions. Minor tranquilizers are used in early stages of labor, while chlorpromazine, a major tranquilizer, and related compounds are also used as adjuncts to general anesthesia during expulsion of fetus.

E. Local anesthetics

Local anesthetics provide relief from pain by blocking the transmission of impulses through the peripheral nerves (Goodman and Gilman, 1970). Used in such a manner, they do not alter alertness of the patient but can supress CNS function if administered in significant amounts. The commonly used local anesthetics are synthetic derivatives of cocaine (e.g., procaine, lidocaine, mepivacaine). They can be divided into two major classes: the esters[2] and the amides[3]. The former include procaine and are generally characterized by a fairly long latent period (between administration and clinical effect) and a relatively poor ability to penetrate tissues. The amides, on the other hand, act more rapidly and longer and penetrate tissues better. This group, which includes lidocaine, prilocaine and mepivacaine, is widely used to provide obstetrical anesthesia.

In obstetrics, the local anesthetics are employed in three principal ways (Davis and Rubin, 1966):

1. Infiltration anesthesia is produced by injecting the drug directly into the tissue (e.g., perineum in preparation for episiotomy). This method is the simplest but not necessarily the safest, as it may require a relatively large quantity of drugs (up to 200 cc of a .05% solution of procaine, or up to 40 ml. of 1% solution of mepivacaine).

2. Conduction block is produced by injecting the drug next to a nerve trunk (pudendal or para-cervical block) (up to 10 ml. of 1% procaine or up to 20 ml. of 1% mepivacaine on each side).

3. Massive block of spinal nerves leading to the lower part of the body can be produced by one of the following techniques:

   a. in spinal anesthesia the drug (0.5 to 2 cc of 10% procaine or 15 to 30 cc of 1% mepivacaine) is injected into the subarachnoid space, in direct contact with the spinal cord. The result is a transient sensory and motor paralysis of the whole lower half of the body. A variant of this technique is the "saddle block," in which the drug is injected in a manner to affect only that area of the body which would touch a saddle (Davis and Rubin, 1966).

   b. in lumbar epidural anesthesia the drug (in amounts similar to those used in spinal anesthesia) is injected between the dura membrane and the bones of the spine. If the injection is made into the caudal canal (which is an extension of the epidural space) it is called caudal anesthesia.

In spinal and epidural anesthesia, relatively small amounts of the drug pass into the general circulation. On the other hand, these massive nerve blocks produce side effects such as the pronounced fall in the mother's blood pressure (a point which will be elaborated later on).

F. Other drugs

Scopolamine (hyoscine) is used as an adjuvant to narcotics and is reputed to induce amnesia of the painful experience. Succinil choline (Anectine) is a muscle relaxant used to facilitate surgery and delivery. Little is known about the possible effects of these drugs on the fetus.

The classification of anesthetics, analgesics and sedatives refers to the principal effect, when the drug is used in typical manner. One should keep in mind, however, that all these drugs affect the function of nervous tissue and their effects may overlap. Thus, higher doses of morphine have a sedative effect, tranquilizers may induce sleep and local anesthetics may cause excitation, convulsions or loss of consciousness if introduced into the brain in large amounts.

In this section we have reviewed the principal anesthetics and analgesics commonly used in obstetrics. We turn now to the utilization processes by both the mother and the neonate.

2. Vicissitudes of drugs used in labor

There has been a considerable amount of research into the effects of drugs on the mother and fetus during labor and delivery. One major factor of paramount importance is the time factor, i.e., the interval between administration and delivery, speed of absorption, rate of placental transfer, rate of metabolic breakdown and elimination. The time factor plays a critical role in evaluating the effects of a drug on the mother and the fetus. Contradictions in the data obtained by different observers about drug effects are partially the result of the fact that not all researchers take into account all of these variables. In addition, many of the original inferences were drawn from animal experiments and it is now recognized that pharmacological effects may differ greatly from man to animal - a point which will be elaborated further on.

When a drug is introduced, by any route, into the mother's body it will:

(a) enter, to some extent at least, into the maternal blood circulation;

(b) be subjected to metabolic transformation by the maternal organism, leading to breakdown and/or elimination;

(c) pass in variable amounts through the placenta and into the fetus and return from fetal into maternal circulation (before severing the cord) to be metabolized by the mother;

(d) become metabolized and/or eliminated by the fetus (and later by the newborn).

Some general comments concerning these various stages will be helpful.

(a) Absorption: drugs injected intravenously enter the circulation instantaneously and within seconds are evenly distributed throughout the body. Inhaled drugs are absorbed almost as rapidly. Intramuscular injection or rectal administration requires several minutes while ingested drugs may require an hour or more before peak blood concentration is reached. Peak blood concentration is not synonymous with maximum effect. In order to exert its effect, the drug has to enter the tissues; in the specific case of central nervous system function, passing the blood brain barrier is involved. The blood brain barrier has a different permeability for different drugs (Harper, 1969). Local anesthetics exert their effect at site of the injection but are always sooner or later absorbed into general circulation.

(b) Metabolism: Gases and volatile anesthetics are largely eliminated through the lungs. Synthetic narcotics and short-acting barbiturates (e.g., thiopental) are metabolized in the liver. Long acting barbiturates are eliminated through the urinary system. Of the local anesthetics, esters are metabolized by hydrolysis (i.e., combining with water and splitting into alcohol and organic acid) and thus inactivated. The amide compounds (e.g., lidocaine, mepivacaine) are metabolized and inactivated by a liver enzyme, amidase (Cohen and Olson, 1970).

Contrary to previous opinions, it is now known that many drugs exert significant effects long after having been apparently eliminated by metabolism and after their blood level drops to insignificant amounts (e.g., secobarbital produces mild sedation up to 20 hours, and chlorpromazine a tranquilizing effect up to six months, Goodman and Gilman, 1970). Ashton and Hibben (1967) (in Goodman and Gilman, 1970, pp. 104) found in an animal study after-effects of barbital anesthesia one month later.

(c) Placental transfer: The old notion of the eighteenth century that the placenta serves as a protective barrier between the fetus' independent circulation and his mother (Corner, 1965) was shattered to pieces in 1961, in the popular beliefs, with the tragedy of thalidomide in Europe, (Nehan and Lampert, 1965). A number of babies, whose mothers took this mild sedative in the first weeks of gestation, were born with limb malformations and with other defects. What was thought, early in this century, to be a semi-permeable membrane separating the two circulations, is now known to be an extremely active metabolic unit (Hagerman and Ville, 1960; Marx, 1961; Moya and Smith, 1965; Watson and Lowery, 1969; Bowes, 1970; Cohen and Olson, 1970).

It is now believed that *any* substance found in the maternal blood will cross the placenta to some extent unless it is altered or destroyed during its passage. Most drugs are transfered by simple diffusion, i.e., the molecules pass from an area of high concentration to one of low concentration with little if any metabolic energy. The rate depends on: (a) lipid solubility (fat solubility); (b) molecular weight of the drug, (drugs with molecular weight up to 600 readily cross the placenta; (c) degree of ionization (non-ionized, i.e., electrically neutral substances cross more readily). Any change in the pH (alkalinity-acidity balance) that *increases* concentration of dissociated, ionized forms, will slow down transfer of drugs (Hageman and Ville, 1960; Cohen and Olson, 1970; Burt, 1971). Normally, the pH (the acid-alkali balance) of the fetal blood is slightly higher, i.e., more alkaline, than that of the mother. However, drugs such as local anesthetics may produce acidosis in the fetus, i.e., lower the pH. In that case, an alkaline drug, such as mepivacaine, after having passed through the placental barrier, may become "trapped" in the fetal circulation because the increased acidity leads to increased ionic dissociation of the alkaline drug and, thus, reduces its diffusibility through the placenta back into maternal circulation (Teramo and Rajamaki, 1971). This may be a possible explanation of why some local anesthetics have been found at higher concentration in the fetal circulation than in the maternal circulation (Teramo and Rajamaki, 1971).

The placenta may also play a role in metabolizing some compounds so that they may reach the fetal circulation faster or be prevented from entering it (Cohen and Olson, 1970). Maternal diseases such as toxemia[4], diabetes or chronic hypertension (high blood pressure) which lead to an altered placental vascular bed may also inhibit passage (Cohen and Olson, 1970).

Transfer occurs also by active transport or by special processes such as pinocytosis (engulfment by leucocytes) or through gaps in the placental villi (finger-like projections). The mechanisms of active transfer are still poorly understood (Hagerman and Ville, 1960).

Drug transfer may also occur via the amniotic fluid to the fetus' circulation. This route is also poorly understood but is most interesting in light of the fact that the pH of amniotic fluid at term is 6.9-7.0 while both fetal and maternal blood pH is 7.35-7.4 (Cohen and Olson, 1970). "This difference in pH could result in some drugs being concentrated in the amniotic fluid and ingested by the fetus in higher dosage than may be suspected from maternal plasma alone." (Cohen and Olson, 1970).

The type of administration of a drug into the maternal circulation will affect the degree of transfer with more of the drug passing to the fetus after intravenous administration to mother than after oral administration or intramuscular injection, holding dosage level constant.

(d) Metabolism by fetus and neonate: Once the umbilical cord is severed, the neonate is on his own as far as the detoxification and elimination of drugs is concerned. The fetal and neonatal metabolism, however, differs significantly from that of the adult. Both liver function and the excretory function of the urinary apparatus are not yet fully developed (Nelson, Vaugham and McKay, 1969 a, b, c). Compared with older children and adults, the elimination of drugs by the neonate is slower. The neonate's liver is deficient in amidase. This makes the newborn susceptible to the toxic effects of the amide group of local anesthetics (Cohen and Olson, 1970). Neonates have difficulties in conjugating bilirubin (the yellow pigmented substance formed by the breakdown of hemoglobin from destroyed red cells). Before being eliminated from the body, bilirubin has to be rendered water soluble by being chemically combined (conjugated) with glucuronic acid. The conjugation is accomplished by an enzyme, glucuronil transferase, which is normally present in liver tissues. The liver of the fetus and newborn has a very low level of this enzyme and the process of bilirubin elimination is much slower in the newborn, especially in the premature baby. Excess bilirubin produces jaundice and the so called "physiological jaundice" of the neonate is thus due to the relative defficiency in the elimination of bilirubin. About 50 percent of full term babies and 80 percent of immature infants develop mild jaundice on the third or fourth days of life, when the unconjugated bilirubin has accumulated in the blood stream and is being deposited in the skin (McKilligin, 1970). Any marked increase in the red cell destruction, such as happens in Rh incompatibility, results in severe jaundice which may lead to death or to brain damage in the form of kernicterus (yellow coloration of basal ganglia of the brain by bilirubin). Conjugation with glucuronic acid is a detoxifying mechanism used for the elimination of a wide variety of foreign substances including such common drugs as salicilates (aspirin), sulfonamide, chloramphenicol, morphine and others. Thus, bilirubin and many drugs compete for the same detoxifying mechanism in the neonate's liver with the result that jaundice may delay elimination of many drugs and many drugs may aggravate jaundice. (Kent, 1959; Lucey and Dolan, 1959; Burns, Hodgman and Cass, 1959; Zuelzer, 1961; Done, 1964; Gustafson, 1965; Nyhan and Lampert, 1965; Adamsons and Joelsson, 1966; Watson and Lowery, 1969; Nelson, et al., a,b, 1969; Burt, 1971).

In order to stimulate the production of the drug-metabolizing enzyme, glucuronil transferase, physicians sometimes advocate the administration of barbiturates (Foutz, 1965; Young and Yu, 1971), such as phenobarbitone, or of benzypirene. This, however, does not solve the whole problem because the neonate's glomerular filtration (passage of the fluids from the blood into the kidney glomeruli and formation of fluid which eventually becomes urine) is low (Nelson, *et al.*, 1969 b). Thus some conjugated bilirubin and/or drug continues to circulate in the neonate's body.

The elimination of drugs may be further slowed down if the metabolic processes are deranged, e.g., by acidosis or lowered body temperature. Since a number of drugs may produce acidosis (e.g., local anesthetics) or interfere with feeding (i.e., reduce caloric intake) and hence interfere with heat regulation, a vicious circle may start. The fall in temperature is even more pronounced in the immature and malnourished infant (Adamsons and Joelsson, 1966).

From the point of administration of the drug to its elimination by the mother and/or neonate is a long and complex process. It is not yet a fully understood process, but what is already known suggests that the introduction of analgesics and anesthetics into the mother's body during labor and delivery starts a chain of effects that invariably add to the demands of the birth process on the system functions in the neonate.

II. Effects on mother and newborn

There have been a number of studies on the effect of obstetrical drugs. The can be divided into two groups: the effect on the mother and the effect on the infants.

1. Effects on maternal physiology and labor

When considering relations between a drug and fetus' metabolism, much more than a simple pharmacological effect of the drug itself may be involved. It is true that in many instances the drug crosses the placenta unchanged and affects the fetus in a fashion similar to that in which it affects adults. Most of the volatile anesthetics, the barbiturates and many narcotic analgesics probably affect the fetus in this manner (as will be described below). But a drug may influence the fetus also by altering the maternal physiology in such a way that the intrauterine environment is changed. It has recently become apparent that spinal anesthesia may have far-reaching consequences even in the cases where drugs themselves do not cross the placenta in significant quantities. At the time of cesarean section, a patient who lies in a supine position and then is given a spinal anesthesia, may experience an alarming hypotension (Ueland, Gills, and Hansen, 1968) which can be reflected in the reduction of fetal oxygenation and increased acidosis (Stenger, Andersen, de Pauda, Eitzman, Gessner, Preptousky, 1964). Anything that alters placental transfer of respiratory gases (oxygen, carbon dioxide) electrolytes, water or metabolic end products (urea) will jeopardize the fetus to a certain extent. Consequently, a drug must be considered not only for its direct effect upon the fetus but also for its indirect and no less important effect on maternal physiology.

Friedman and Sachlleben (1961) have warned against dysfunctional labor due to a prolonged latent stage (predilatation stage of the contractions). Both local and general anesthesia may have adverse effects on the fetus since they may unnecessarily prolong the latent stage (above 20 hours) to the point of dysfunctional labor (contractions which do not produce dilatation and expulsion of the fetus). Dysfunctional labor may lead to asphyxia (suffocation). Lucey, Hibbard, Behrmna, Esquivel de Gallando and Windle (1964) have found a significant correlation between asphyxia and kernicterus in Rhesus monkeys, and they have concluded that the more immature the newborn the greater the dangers of birth asphyxia, intrauterine insults and drug effects.

2. Direct effects on newborn

The newborn's transition from intrauterine to extrauterine life imposes upon him the need to activate a number of functions that have been dormant or incompletely activated (Snyder, 1949). Some of them, such as respiratory activity and maintenance of body temperature, must be established immediately at some minimal level of acceptable functioning.

The birth process itself with the sudden, often catastrophic, alteration in physiology may be a hazardous experience for the fetus. James (1960) at Columbia University studied a large number of babies immediately after birth and found that all the infants were subjected to varying degrees of oxygen deprivation and carbon dioxide retention during the course of labor and delivery. Under normal circumstances most infants tolerate this brief "asphyxia" without difficulties and within a short time show little evidence of the biochemical storm they have recently survived. Failure of the oxygen supply during labor, however, results in depression or absence of fetal respiratory movement at birth,[5] as well as in vascular injuries giving rise to edema and hemorrhages of the lungs and other organs. These, in turn, aggravate the lack of oxygen thus creating a vicious cycle (James, 1960).

In premature infants, oxygen deprivation is closely linked with perinatal mortality. Thus, the fetal respiratory system is the site of greatest vulnerability to injury in labor and delivery and that is why for years the majority of the research has been concerned with the relation of obstetric medications and neonatal depression[6] (Snyder, 1949). Even in 1933, Shute and Davis observed that morphine could increase the chances of asphyxia in utero as indicated by change of rhythm of fetal heart. Asphyxiated infants were, in turn, more susceptible to morphine and showed severe symptoms of narcosis. Snyder (1949) summed it up: "All drugs commonly given for the relief of pain tend to alter the functioning of respiration thus striking the fetus at the point which has been found to be of maximum susceptibility to injury during labor." Many observers disagree with the statement and the research on whether narcotics (e.g., meperidine) cause depression in the newborn, ranges from studies that claim zero percent depression to studies that attribute 32% of their newborn depression to meperidine (Shnider and Moya, 1964). Garcia, Waltham and Lubin (1953) even recommended the administration of meperidine in quantities of up to 100 mg., but they also reported that some of the babies in their study had to be resuscitated by artificial respiration lasting up to 90 seconds before onset of respiration. However, they did not attribute such depression to meperidine. Others, such as Zaru, Esposito and Zaru (1967), have advocated continuous infusion of meperidine (average per hour 40.3 mg.) since "obstetric and subjective evaluation of pain relief was excellent and newborn depression was not significant." In contrast, Flowers, Rudolph and Desmond (1969, who used diazepam (Valium) which is classified as a "minor" tranquilizer and a mild analgesic, found that a significant percentage of neonates suffered moderate depression and some showed severe depression in comparison with a control group that did not have any drugs. Flowers, et al. attributed the depression to a hypotonic effect of diazepam and not to any direct effect of the respiratory center in the CNS. This drug has lately been used in the management of neonatal narcotic withdrawal syndrome (Nathenson, Golden and Litt, 1971), since it produces temporary hypoactivity and hypotonicity in neonates. The concentration of barbiturates, e.g., amylobarbitone, in the fetal liver is already relatively high ½ to 2 hours after injection and decreases very slowly. This accumulation might indicate an exhaustion of the detoxicating capacity of fetal liver (Ploman and Persson, 1957). Ploman and Persson (1957) also studied the concentration of barbiturates in fetal brains. They found a much higher amount of barbiturates concentration in the region of the fourth ventricle as compared to the cortex. This is significant since the medullar respiratory center lies in the vicinity of the fourth ventricle.

Despite these findings, Bran and Montalvo in 1971, advocate the use of barbiturates in labor, claiming (on the basis of animal experiments) that barbiturates protect the neonates against the effects of prolonged anoxia (oxygen deprivation). Epstein and Coacley (1967) reported that local anesthetics (lidocaine and prilocaine) had little depressing effect on the neonate. However, Levy (1953) and Morisima, Daniel, Finster, Popper and James (1966) found that a relatively high percentage of neonates were depressed even with local anesthetics such as mepivacaine. These drugs, which were not supposed to reach the fetus, did pass through the so called placental barrier into the fetal blood stream in significant amounts.

Drugs may affect the neonate's respiration in other ways too. For example, reserpine is a relatively mild tranquilizer; for this reason it has been employed to ease the course of labor. The adverse effects in the adult do not appear to be disturbing. Stuffiness of the nose is the major frequent complaint. A stuffy nose in the newborn may, on the other hand, produce mild to severe respiratory difficulty because of the relative inability of the infant to breathe through the mouth (Nyhan and Lampert, 1965).

The confusing and contradictory data on depression of neonates produced by different drugs may be due to two reasons. Firstly, many of the basic experiments have been conducted on animals. Animals differ in their reaction to drugs and are certainly different from humans (Done, 1964). For example, thalidomide did not produce any teratogenic effect (maldevelopment) in rats and in monkeys it produced only sterility (Nyhan and Lampert, 1965). Secondly, the importance of the time interval between administration and delivery has often been overlooked, even though there has been important evidence about this factor since 1933. That year Shute and Davis pointed out that morphine has the maximum effect on the neonate when administered to the mother in labor anywhere between one and six hours before delivery. This was true even if mothers had received only 50 mg. of meperidine. Shnider and Moya (1964) sutdied the effects of meperidine on newborn infants and found that there was no statistically significant effect if the drugs were administered within one hour before birth (confirming Shute and Davis' conclusions). However, there was a significant increase in the percentage of depressed babies if the drug was administered more than one hour before delivery. This was true even if mothers had received only 50 mg. of meperidine. Peak effect of drugs occurred if the drug had been administered somewhere between 3½-4 hours prior to delivery. These conclusions are quoted by many writers. Shnider and Moya and other investigators have based their conclusions on the Apgar[7] Score taken at 1 and 5 minutes immediately after birth. Shnider and Moya's results could be explained by suggesting that if the drug is administered less than one hour before birth, the newborn will receive a significantly smaller amount of drugs. However, as mentioned before, the drugs that pass through the placenta do so within seconds after the injection or inhalation and thus the explanation can be questioned. A more likely possibility is that the observations of Shnider and Moya and others can be explained by the fact that the babies in their studies were examined for depression in the first minutes after delivery and none of the studies concerned mentions the search for drug effects after two, three, or more hours after delivery. Thus, one may suspect that babies whose mothers' were given medications during the last hour preceding delivery are not necessarily free from effects of the drug but that the peak effect has yet to manifest itself.

It is the pediatrician who sees the newborn two, three or more hours after delivery. Brazelton (1970) noted: "...(Some) neonates had excellent Apgar Scores in the delivery room and remained clinically responsive for half an hour - long enough to be sent to the nursery downstairs. After this initial period of responsiveness, (which I now postulate is largely due to the neonate's ability to mobilize his resources to respond to the stimulation of labor, delivery and the onslaught of new environmental stimuli), these babies shifted rapidly into a frightening state of relative unresponsiveness and they became unresponsive to any but very disturbing stimuli, with little spontaneous motor activity; they also had very slow heart and respiratory rates. Diffuse acrocyanosis (bluish extremeties) demonstrated their poor circulatory response to the hypoxia that was present, and their ability to clear mucus from their airways became impaired. This depressed behavior lasted for a period of a few hours to a day and then tapered off not-so-gradually; subclinical behavior manifestations could be demonstrated for as long as a week in many infants." (Brazelton and Robey, 1965).

Drug effects are not limited to the functions measurable by the Apgar Scale, which is clinically useful but a rather crude estimate of infantile physiology. There have been a few attempts to investigate other aspects of infant's behavior and functioning using EEG, sucking behavior, sleep and smiling, attention and mother-child interactions. In some of these areas there is only the briefest of literature; in others, it is a bit more extensive; in none of them is there a definitive literature.

Neurologic examination and EEG

Borgstedt and Rosen (1968), in a controlled study of 52 infants, found that "behavioral impairment" (as measured by infant's alertness and reactivity) as well as EEG alterations were highly correlated with obstetric medication (meperidine, prometazine, phenobarbital). The behavioral changes disappeared in most cases within three days, but EEG changes persisted in ten infants.

Sucking

Both Brazelton (1961 II) and Kron (1966) independently studied sucking behavior. In Brazelton's study, two groups of neonates were evaluated. One had relatively little premedication, i.e., barbiturates not exceeding 60 mg. with or without anesthetic, general or local; and the other group, 150 mg. or more with general or local anesthesia. The less medicated group started to suck well on the second day. The neonates in the heavy premedication group showed a lag of 48 hours duration in their specific ability to adapt to breast feeding. Weight gain was also delayed 24 hours in the heavily medicated group. Kron's (1966) results confirmed these findings. His control group had no medications and he used a more refined measure of sucking. The bottle was attached to instruments which measured the rate of feeding, pressure of suction and amounts. By studying only bottle fed babies, the possibly confounding factor of drug effects on the nursing mother was excluded.

The implications of these studies are related to the fact that body temperature control may be affected by inadequate caloric intake.

REM and Smiling

Emde and Koening (1969 a, b) found that neonatal smiling occurred during states of REM sleep[8] and drowsy REM and had a significant tendency to occur in bursts. Smiling was also found to have a characteristic distribution within each REM period and to be evenly distributed across successive REM periods. Amount of smiling was found to be influenced by depressant medications given to the mother within 8 hours before delivery. Infants of these mothers smiled significantly less both in number of smiles and smiles weighed for intensity. Medications did not seem to affect the length of REM states.

Attention

Stechler (1964) found that visual attentiveness in 2 to 4 day old infants, was affected if the mother had received analgesics and hypnotic drugs during labor. There was negative correlation between the dosage of the depressing drugs and neonates' attention to visual stimuli. In a study that is not directly related to our discussion, Lewis, Bartels, Campbell and Goldberg (1967) used the Apgar Scale as a measure of condition at birth against which they compared the visual attentive behavior of infants at 3, 9 and 13 months. Their data indicated that infants who rated between 7 to 9 on the Apgar Scale at birth were significantly less attentive than infants who rated 10. This difference, in general, held over the first year of life and according to Lewis _et al_., indicate that individual differences in infant attention within the first year of life are a function, in part, of birth condition. Lewis, _et al_. also found that habituation at the age of three months in high Apgar score infants was much more rapid than in the low score infants. There was no difference in habituation rate at 9 and 13 months. Lewis, _et al_., however, do not relate their observations to maternal medication of their subjects, but instead discussed the birth condition as a global concept. Conway and Brackbill (1970) found that neonates who have been subjected to greater amounts of obstetrical medication (analgesics and anesthetics) lagged significantly in their ability to inhibit responding to an auditory stimulus.

These findings may have important implications concerning the welfare of the infant since "habituation is the efficient response to stimulation that is no longer providing the organism with useful information" (Lewis, et al.). Neonates just cannot get up and walk away from the stimulus which by then may become aversive for them. Conway and Brackbill (1970), who studied the infants on their second and fifth days and at one month, also found that "the medicated neonates performed significantly poorer on standard behavioral tests than infants whose mothers have not been medicated during labor." The differences persisted even at the age of one month -- as measured by the Bayley Motor Scale (1969), which at the one month age level consists largely of postural adjustment items. No significant differences were noticed for the Bayley Mental Scale, in which the age appropriate items concentrate more heavily on testing visual regard, that is, eye coordination and following in horizontal, vertical, and circular direction. Visual differences were also found at 5 days of age, but no differences were found on the second day, probably because of the swelling of the eyelids and consequent visual impairment caused by the silver nitrate given to all infants shortly after delivery. Significant differences were found at 2 and 5 days in performance on the Graham Muscle Tension Subscale (Graham, 1956). The babies with history of obstetrical medication performed less well. Conway and Brackbill followed some babies till the age of 5 months. At this age there were no significant differences on the Bayley Scale nor in habituation scores although the latter showed a tendency toward quicker habituation with less medication (Conway, 1972).

Footnotes

1. The reader will find Goodman & Gilman (1970) complete reference on drug treatment and Snyder (1949) good reference on obstetric anesthesia and analgesia.

2. An ester is an organic compound formed by combining an alcohol with an acid (Harper, 1969, p. 543).

3. Amides are compounds containing the group $-CO(NH_2)$ or its substitutes (Harper, 1969, p. 545).

4. Toxemia is a toxic state associated with pregnancy and its main symptoms are: elevated blood pressure, excessive vomiting, change in kidney function.

5. The fetus has respiratory movements already in utero and they increase when term approaches.

6. "Neonatal depression" means a reduction or slowing down of a number of physiological functions: respiration, heart rate, mobility, etc.

7. The Apgar Score is based upon the combined rating of five indicators: heart rate, respiratory effort, muscle tone, reflex irratibility and color as judged at 1 minute and 5 minute intervals after delivery. Each is rated on a scale of 0 to 2, with zero indicating no function; 1, function present but poor; and 2, function perfect. Thus, an infant in perfect condition would receive a score of 10. This Scale is now used by most obstetricians and researchers in order to determine intensity of neonatal depression (Apgar, V., 1953).

8. REM or Rapid Eye Movement sleep is the phase of sleep usually associated with dreaming and also called "active sleep." The time percentage of active sleep (compared to total sleep time) decreases progressively from 80% in premature newborns to 18% in adults. Sedatives decrease REM in adults (Hartman, 1966).

APPENDIX B

APPENDIX B

MANUAL FOR SCORING THE BRAZELTON SCALE

. Recommended Scale Order (See discussion above)

1. Observe infant for 2 minutes - note state
2. Flashlight (3-10x) through closed lids
3. Rattle (3-10x)
4. Bell (3-10x)

5. Uncover infant
6. Light pinprick (4x)
7. Ankle clonus
8. Plantar grasp
9. Babinski

10. Undress infant
11. Palmar grasp
12. Passive movements and general tone
13. Orientation inanimate: visual, auditory

14. Pull to sit
15. Standing
16. Walking
17. Placing
18. Incurvation
19. Body tone across hand
20. Crawling - prone responses

21. Pick up and hold
22. Glabella reflex
23. Spin - tonic deviation and nystagmus
24. Orientation - animate: visual, auditory, visual and auditory

25. Cloth on face
26. TNR
27. Moro

. States

"State of consciousness" or "state" is one of the most important variables in any observation period. Reactions to stimuli must be interpreted within the context of the presenting state of consciousness. These reactions vary markedly from state to state in each infant. State depends on physiological variables such as hunger, nutrition, degree of hydr[illegible]ion, time within the wake-sleep cycle of the infant, etc. The patterns of states as well as the movement from one state to another appear to be important characteristics of infants in the neonatal period, and this kind of evaluation may be the best predictor of the infant's receptivity and ability to respond to stimuli in a cognitive sense. Our criteria for determining states are based on our experiences and on those of others, and are comparable to the descriptions of Prechtl, et al. (16).

Sleep States

(1) Deep sleep with no spontaneous activity except startles or startle equivalents at quite regular intervals; external stimuli produce startles with some delay; suppression of startles is rapid, and state changes are less likely.

(2) Light sleep with eyes closed, low activity level with random movements and startles or startle equivalents; responsive to internal and external stimuli with startle equivalents, often with a resulting change of state.

Awake States

(3) Eyes may be open or closed, eyelids fluttering, drowsy, or semi-dozing; activity level variable with interspersed mild startles from time to time; reactive to sensory stimuli, but delay in response often seen; state change after stimulation frequently noted.

(4) Alert, bright look; seems to focus attention on source of stimulation such as an object to be sucked, visual or auditory stimulus; impinging stimuli may break through, but with some delay. Motor activity is at a minimum.

(5) Eyes open, considerable motor activity with thrusting movements of extremities, even a few spontaneous startles; reactive to external stimulation with increase in startles or motor activity, but discrete reactions difficult to distinguish because of general high activity level. Intermittent fussing does not result in a change of state.

(6) Crying. Characterized by intense crying which is difficult to break through with stimulation.

We have suggested in parentheses appropriate states in which the assessment can be made for each state. Since state behavior is an integral part of any observation of the newborn, it is vital that this reflect the starting point from which all the rest of the observations are made. The reactions are state-related, and an infant's use of states as a framework for his reactions to the observer may be most important as part of the observation.

Initial State

In the two minutes before stimulation is begun, an assessment of the infant is made by observing the infant's spontaneous behavior, respirations (as observed by the movement of the gown or covering sheet), eye movements, startles, and responses to concurrent spontaneous events in the environment. States are scored according to the criteria given above.

Predominant States

At the end of the observation period, E should record the two or, at most, three states within which the infant performed. Since the most important influence on his scores will be his available states, it is important to have an idea of the range, as well as the kinds of states used by the infant in this period, their importance to him in controlling himself, and the amount of time spent in them.

IX. Scale Items and Manual Description

1. Response Decrement to Light (2,3)

One of the most impressive mechanisms in the neonate is his capacity to decrease responses to repeated, disturbing stimuli. This should measure the decrement which occurs in a quiet state (2,3) after the infant has responded with an aversive reaction to the flashlight shined briefly into his eyes (closed or open). Since some babies alert as the light is used, there is no observable aversive reaction. When this happens, wait until he is alert, and after he begins to react with an aversive reaction (tight blinking, general motor activity, and change in respiration) habituation is measured by a real decrement in the extent of the above.

Up to 10 stimuli can be used. Criterion for shutdown equals two trials past. Score the most observed decrement. Stimuli presented every five seconds after the end of each previous response. This implies the observer's ability to judge the end of each reaction. This test should be done with a standard 8" flashlight with two medium sized batteries in good working condition. Flashes must be discrete and ambient noise level should be accounted for and ruled out as much as possible. Of course, a baby in a semi-darkened quiet room will respond differently than one in a brightly lit noisy nursery, and the ideal of the quiet, darkened room cannot always be achieved. Reactions which are graded in terms of the neonate's ability to control them over time are: a) all or none startle of entire body, b) delayed and graded localized startle, c) respiratory changes, d) blinks of eyelids. Delaying and finally shutting out any reactions are degrees of the same kind of habituation. Evaluate him at the end of 10 flashes for scoring unless he has successfully reached criterion before that. If baby is too sleepy to show a response, he can be roused slightly by shaking the bed or uncovering him. If there's never any response, score him NA.

1 - No diminution in high response over the 10 stimuli.
2 - Delayed startles and rest of responses are still present, i.e., body movement, eye blinks, respiratory changes continue over 10 trials.
3 - Startles no longer present but rest are still present, including body movement in 10 trials.
4 - No startles, body movement delayed, respiratory and blinks same in 10 trials.
5 - Shutdown of body movements, some diminution in blinks and respiratory changes in 9-10 stimuli.
6 - ... in 7-8 stimuli.
7 - ... in 5-6 stimuli.
8 - ... in 3-4 stimuli.
9 - ... in 1-2 stimuli.

2. Response Decrement to Rattle
See below.

3. Response Decrement to Bell (2,3)

These are a measure of the neonate's ability to shut out a disturbing auditory stimulus. Hence (as in habituation to light) the stimulus must be able to break through his ambient state and create a startle response. The bell may be more successful in producing a startle response, especially in a noisy nursery. Often the rattle may bring him out of his generally shut-down state, and the test should then be completed with the bell. A bell is that used in a standard Gesell test. He is scored (as above) for an aversive reaction (general startle, tight blinking and respiratory changes). As he habituates, he tends to delay these reactions and finally shuts them out. Often the shut-out is a temporary one, but this reflects his capacity to do so. If the baby is too sleepy to show a response, he can be roused slightly by shaking the bed or uncovering him. If there's never any response, score him NA.

Stimuli are brief, discrete and presented five seconds after the end of the previous response while the baby is in state 2 or 3. Present the stimulus until you have had no response for three consecutive times or until 10 stimuli have been presented. After the rattle, repeat the procedure with the bell.

1 - No diminution in high response over the 10 stimuli.
2 - Delayed startles and rest of responses are still present, i.e., body movement, eye blinks, respiratory changes continue over 10 trials.
3 - Startles no longer present but rest are still present, including body movement in 10 trials.
4 - No startles, body movement delayed, respiratory and blinks same in 10 trials.
5 - Shutdown of body movements, some diminution in blinks and respiratory changes in 9-10 stimuli.
6 - ... in 7-8 stimuli.
7 - ... in 5-6 stimuli.
8 - ... in 3-4 stimuli.
9 - ... in 1-2 stimuli.

4. Response Decrement to Pinprick (1,2,3)

As a test of response decrement to tactile stimulation the diaper pin may be used to prick the heel of the infant's foot when he is quiet. This may be repeated several times. The examiner watches for how totally and how rapidly the whole body responds to this pinprick. In an immature or CNS-damaged infant, the opposite foot withdraws and the whole body responds as quickly as the stimulated foot (a demonstration of the all-or-none aspect of an immature organism). The degree, rapidity, and repetition of this "spread" of stimulus to the rest of the body is measured here. The other aspect is the infant's capacity to shut down this spread of a generalized response. When he continues to respond in an obligatory, repetitive way, he rates a low score. As he demonstrates a suppression of responses to the stimulus and changes his state to a more alert, receptive one, he deserves a high score. Many infants demonstrate some but not all of this behavior, and it may be evidence of excellent CNS function. Middle scores are saved for infants who demonstrate some habituation but not an accompanying state change of alertness.

The foot should be pricked at least four times. If no response decrement occurs, the stimulation should be stopped. If decrement occurs, a fifth stimulus and more can be applied to test the extent of the decrement. (For the squeamish, an appropriate stimulis is a pin pushed through a cork to extend 1/16th of an inch beyond the cork.)

1 - Response generalized to whole body. Both feet withdraw together. No decrement in response.

2 - Response limited to stimulated foot. No decrement of response.
3 - Variable response to stimulus. Response decrement but return of response.
4 - Response decrement after five trials. Localized to stimulated leg. No change to alert state.
5 - Response decrement after five trials. Localized to stimulated foot. No change to alert state.
6 - Response limited to stimulated foot after 3-4 trials. No change to alert state.
7 - Response limited to stimulated foot after 1-2 trials. No change to alert state.
8 - Response localized and minimal. Change to alert state (4).
9 - Complete response decrement. Change to alert state (4).

5. Orientation Response - Inanimate Visual (4 only)

Since most neonates will demonstrate some ability to fix on a visual object (a contrasting bright or shiny object, e.g., a bell, red ball, white mask) and follow it horizontally for brief excursions, this is a measure of that ability. It is highly state-related, and may not be demonstrated in any one exam, but, under optimal conditions (a quiet, semi-dark room), it is repeatable; following with the eyes is also accompanied by head-turning to follow. Vertical following seems of an even higher order, and many babies will stretch their necks to follow up and down. This is a summary score.

The infant may respond with (1) alerting (decrease in random activity, focus on examiner's face when it is in his line of vision, slow regular respirations, and follows face when it moves in arcs) and (2) brightening (change in facial expression, widening of eyes and brighter look, jagged respirations, with an associated decrease in random activity).

When the infant will not attend or follow in the bassinet; he may be held on the E's lap, slightly propped up. This facilitates his doll's eye reflex; his eyes open, and he attends to the object. Obviously, the act of holding him restrains interfering movement and helps alert him. But he may also be distracted by the examiner's face. Held at the E's shoulder, his following responses can be determined by another examiner.

1 - Does not focus on or follow stimulus.
2 - Stills with stimulus but no focus.
3 - Stills, focuses on stimulus when presented, little spontaneous interest, no following.
4 - Stills, focuses on stimulus, brief following.
5 - Focuses and follows with eyes horizontally and/or vertically for at least a 30° arc. Jerky movement,

loses stimulus but finds it again. No following with head, some spontaneous interest.

6 - Follows for 30° arcs, not with head. Eye movements are smooth.

7 - Follows with eyes and head at least 60° horizontally, briefly vertically, partially continuous movement, loses stimulus occasionally, head turns to follow.

8 - Follows with eyes and head 60° horizontally and 30° vertically.

9 - Focuses on stimulus and follows with smooth, continuous head movement horizontally, vertically, and in a circle. Follows for at least a 120° arc.

6. Orientation Response - Inanimate Auditory (4,5 states)

This is a measure of his response to the rattle or a soft bell (non-social) as a stimulus when he is in an alert state. The auditory stimuli should be presented to one side and out of sight (at least 6" away and no more than 12") so that one can observe the infant's eyes and head as they respond to the lateralized stimulus. This scores his best performance in one of the awake states to the stimulus. Latency altering degree of eye shift and head turning to the stimulus are scored. Brightening of face and eyes can be seen, and they are evidences of his attention to the stimulus.

1 - No reaction.

2 - Respiratory change or blink only.

3 - General quieting as well as blink and respiratory changes.

4 - Stills, brightens, no attempt to locate source.

5 - Shifting of eyes to sound, as well as stills and brightens.

6 - Alerting and shifting of eyes and head turn to source.

7 - Alerting, head turns to stimulus, and search with eyes.

8 - Alerting prolonged, head and eyes turn to stimulus repeatedly.

9 - Turning and alerting to stimulus presented on both sides on every presentation of stimulus.

7. Orientation - Animate Visual (4 only)

The next three items score the attention which is called up by the examiner's social cues--voice, face, cuddling, holding, rocking, etc. The infant may respond with alerting, brightening, and settling into the arms. He may turn his head to seek the voice or face. Having caught the examiner, he may rivet his attention, and "lock" on for long periods. No interest is unusual. How he is held may strongly influence this, and the E should attempt to reproduce two maneuvers commonly used by mothers: (1) hold the infant in a cuddled position in the arms up against the chest, and (2) upright on the shoulder in a bubbling position.

For the "visual only" item the examiner places his face in the B's line of vision then moves it slowly in lateral and vertical arcs until the B stops following.

1 - Does not focus on or follow stimulus.
2 - Stills with stimulus but no focus.
3 - Stills, focuses on stimulus when presented, little spontaneous interest, no following.
4 - Stills, focuses on stimulus, brief following.
5 - Focuses and follows with eyes horizontally and/or vertically for at least a 30° arc. Jerky movement, loses stimulus but finds it again. No following with head, some spontaneous interest.
6 - Follows for 30° arcs, not with head. Eye movements are smooth.
7 - Follows with eyes and head at least 60° horizontally, briefly vertically, partially continuous movement, loses stimulus occasionally, head turns to follow.
8 - Follows with eyes and head 60° horizontally and 30° vertically.
9 - Focuses on stimulus and follows with smooth, continuous head movement horizontally, vertically, and in a circle. Follows for at least a 120° arc.

8. Orientation - Animate Auditory (4,5)

The examiner removes his face from infant's line of sight and talks to him from one side (6 to 12 inches from ear).

1 - No reaction.
2 - Respiratory change or blink only.
3 - General quieting as well as blink and respiratory changes.
4 - Stills, brightens, no attempt to locate source.
5 - Shifting of eyes to sound, as well as stills and brightens.
6 - Alerting and shifting of eyes and head turn to source.
7 - Alerting, head turns to stimulus, and search with eyes.
8 - Alerting prolonged, head and eyes turn to stimulus repeatedly.
9 - Turning and alerting to stimulus presented on both sides on every presentation of stimulus.

9. Orientation Animate - Visual and Auditory (4 only)

The same criteria for scoring are used as in Items 5 and 7. The same conditions pertain except that the examiner's voice is used to reinforce face, both on the bed and when infant is held. Voice is continuous while face is moving.

1 - Does not focus on or follow stimulus.
2 - Stills with stimulus but no focus.
3 - Stills, focuses on stimulus when presented, little spontaneous interest, no following.
4 - Stills, focuses on stimulus, brief following.
5 - Focuses and follows with eyes horizontally and/or vertically for at least a 30° arc. Jerky movement, loses stimulus but finds it again. No following with head, some spontaneous interest.
6 - Follows for 30° arcs, not with head. Eye movements are smooth.
7 - Follows with eyes and head at least 60° horizontally, briefly vertically, partially continuous movement, loses stimulus occasionally, head turns to follow.
8 - Follows with eyes and head 60° horizontally and 30° vertically.
9 - Focuses on stimulus and follows with smooth, continuous head movement horizontally, vertically, and in a circle. Follows for at least a 120° arc.

10. Alertness (4 only)

This is an assessment of the frequency of the best periods of performance in 4. Often this is elicited while the E holds the infant. Since newborns are as variable as they are, and are alert for such a short period, one must assume that any period of alertness in a 30 minute exam may be taken as an index of the infant's "capacity for responsiveness." In a less randomly selected time sample than this, or when one can wait for a spontaneous period of alertness, this measure might be a better index of his availability, but I have found that most infants show small periods of alert behavior during an exam. These should be assessed. Alerting is defined as brightening and widening of eyes, while orienting is used for the response of turning toward the direction of stimulation.

1 - Inattentive--rarely or never responsive to direct stimulation.
2 - When alert responsivity brief and generally quite delayed--alerting and orientation very brief and general.
3 - When alert responsivity brief and somewhat delayed--quality of alertness variable.

4 - When alert, responsivity somewhat brief but not generally delayed though variable.
5 - When alert, responsivity of moderate duration and response generally not delayed and less variable.
6 - When alert, responsivity moderately sustained and not delayed. May use stimulation to come to alert state.
7 - When alert, episodes are of generally sustained duration, etc.
8 - Always has sustained periods of alertness in best periods. Alerting and orientation frequent and reliable. Stimulation brings infant to alert state and quiets infant.
9 - Always alert in best periods. Stimulation always elicits alerting, orienting. Infant reliably uses stimulation to quiet self or maintain quiet state.

11. General Tonus - Predominant Tone (4,5)

This scores the tone of the baby in his most characteristic states of responsiveness. Since this must be a summary assessment, it should include the overall use of tone as he responds to being handled. This should be assessed in state 4--unless there is no opportunity to produce such an assessment. This should not be assessed in 6.

Tone is assessed in such maneuvers as spontaneous activity, pull to sit, holding him over hand horizontally, prone placement, etc., and should be an overall assessment of his body tone as he reacts to all of these.

1 - Flaccid, limp like a ragdoll, no resistance when limbs are moved, complete head lag in pull to sit.
2 - Little response felt as he is moved, but less than about 25% of the time.
3 - Flaccid, limp most of the time, but is responsive about 25% of the time with some tone.
4 - Some tone half the time, responds to being handled with some tone less than half the time.
5 - Tone when handled, lies in fairly flaccid state in between handling.
6 - Variable tone in resting, responsive with good tone as he is handled approximately 75% of the time.
7 - Is on the hypertonic side approximately 50% of the time.
8 - When handled he is responsive with hypertonicity about 75% of the time.
9 - Hypertonic at rest (in flexion) and hypertonic all the time (abnormal).

Supplementary Score - After most of the shaped summary scores, there will be an opportunity to score a second kind of observation.

This need not be utilized. When it is used, it will mean that the first score represents the score for the major part of the observation, since using a summary score for two very divergent types of behavior negates the importance of each. This second score gives an opportunity to assess body tone of a secondary kind and, also, some idea of the range of tone which the baby may present. Hence, this can be used to denote a minority value, which may or may not have significance for the long run. For example, this score could predict future behavior, or it may present evidence to contradict complete reliance on the summary score.

12. Motor Maturity (4,5)

This is a measure of motor responses--spontaneous and elicited--assessed throughout the exam in the alert states. The arm movements become the easiest to score. The assessment is of (1) smoothness versus jerkiness which reflects the balanced flexor and extensors versus the unbalanced cogwheel movement of the premature or CNS irritation with flexors and extensors competing, and (2) freedom of arcs of movement (90°)(arms on bed) versus restricted arcs (45° etc.)(arms and legs in flexion). The premature has unlimited freedom of movement (floppy) in lateral, sagittal, and cephalad areas, but the movements are jerky and cog-like, overshooting their marks. The very mature infant has both freedom of movement in all directions associated with a smooth, balanced performance (not floppy). The average newborn is somewhat limited in arcs of movement--especially those above the head, and somewhat in the lateral plane.

1 - Cogwheel-like jerkiness, overshooting of legs and arms in all directions.
2 - Jerky movements and/or mild overshooting.
3 - Jerky movements, no overshooting.
4 - Only occasional jerky movements predominating arcs to 45°.
5 - Smooth movements predominate, arcs predominately 60° half the time.
6 - Smooth movements, arcs predominately 60°.
7 - Smooth movements and arcs of 90° less than half of the time.
8 - Smooth movements and unrestricted arms laterally 90° most of the time.
9 - Smoothness, unrestricted (90°) all of the time.

13. Pull-to-sit (3,5)

The examiner places a forefinger in each of the infant's palms. With the arms extended, the infant's automatic grasp is used to pull him to sit. The shoulder girdle muscles should respond with tone, and muscular attempts to participate as he is pulled into a sitting position. Usually he will also attempt to right his head into a position which is in the midline of his trunk and parallel to his body. Since his head is heavy and out of proportion to the rest of his body mass, this is not usually possible and his head falls backward as he comes up. In a seated position, he attempts to right his head, and it may fall forward. Several attempts to right it can be felt via the shoulder muscles as the examiner maintains his grasp on the infant's arms. A few infants make no attempt at all.

Some infants resist flexion and head righting by arching backward. This must be overcome before he can be scored. The average infant makes one or two attempts to maintain his head in an upright position after he is seated, and can participate as he is brought to sit. This should be scored when he is awake enough to participate (3,5), and is scored on his best performance.

1 - Head flops completely in pull to sit, no attempts to right it in sitting.
2 - Futile attempts to right head but some shoulder tone increase is felt.
3 - Slight increase in shoulder tone, seating brings head up once but not maintained, no further efforts.
4 - Shoulder and arm tone increase, seating brings head up, not maintained but there are further efforts to right it.
5 - Head and shoulder tone increase as pulled to sit, brings head up once to midline by self as well, maintains it for 1-2 seconds.
6 - Head brought up twice after seated, shoulder tone increase as comes to sit, and maintained for more than 2 seconds.
7 - Shoulder tone increase but head not maintained until seated, then can keep it in position 10 seconds.
8 - Excellent shoulder tone, head up while brought up but cannot maintain without falling, repeatedly rights it.
9 - Head up during lift and maintained for one minute after seated, shoulder girdle and whole body tone increases as pulled to sit.

14. Cuddliness (4,5)

This is a measure of the infant's response to being held. There are several components which are scored in summary of his responses to being held in a cuddled position against the examiner's chest, and up on his shoulder. The responses are a measure of his negative, or positive responses, as well as none at all.

1 - Actually resists being held, continuously pushing away, thrashing or stiffening.
2 - Resists being held most but not all of the time.

3 - Doesn't resist but doesn't participate either, lies passively in arms and against shoulder (like a sack of meal).
4 - Eventually molds into arms, but after a lot of nestling and cuddling by examiner.
5 - Usually molds and relaxes when first held, i.e., nestles head in crook of neck and of elbow of examiner. Turns toward body when held horizontally, on shoulder he seems to lean forward.
6 - Always molds initially with above activity.
7 - Always molds initially with nestling, and turning toward body, and leaning forward.
8 - In addition to molding and relaxing, he nestles and turns head, leans forward on shoulder, fits feet into cavity of other arm, all of body participates.
9 - All of the above, and baby grasps hold of the examiner to cling.

15. Defensive Movements (4)

A small cloth is placed with examiner's fingers asserting light pressur over the upper part of the face which would partially occlude the nose, and is kept in place for one minute, or until the infant responds with a series of responses: (1) general quieting (b) mouthing (c) head turning and rooting from side to side (d) head turning lateral as well as neck stretching up and down (e) general undirected increase in activity (f) directed swipes in general area of cloth (g) directed swipes in specific area of cloth which removes the cloth. Infant's hands should not be under cloth.

1 - No response.
2 - General quieting.
3 - Nonspecific activity increase with long latency.
4 - Same with short latency.
5 - Rooting and lateral head turning.
6 - Neck stretching.
7 - Nondirected swipes of arms.
8 - Directed swipes of arms.
9 - Successful removal of cloth with swipes.

16. Consolability with Intervention (6 to 5,4,3,2)

This is measured in an upset state after the infant has been actively fussing or crying for 15 seconds. If he never becomes that upset, it must be scored NA. This measures the number of activities on the part of E which are necessary to interfere with this fussing state and allow the baby to move to a quieter state. Some infants will quiet only when they are dressed and left alone. Any stimulus from the environment disturbs them. Others will quiet when they are held and actively rocked. A steady hand held on a crying baby's belly will act as a soothing stimulus. Others need one or both arms held in addition to the hand on the belly. Holding the arm or arms interferes with the disturbing startle activity which gets triggered off by crying or fussing. A few babies may quiet to the E's voice or face. They should be graded in the reverse order, and best performance is scored.

1 - Not consolable.
2 - Pacifier in addition to dressing, holding and rocking.
3 - Dressing, holding in arms and rocking.
4 - Holding and rocking.
5 - Picking up and holding.
6 - Hand on belly and restraining both arms.
7 - Hand on belly steadily.
8 - Examiner's voice and face alone.
9 - Examiner's face alone.

17. Peak of Excitement (6)

This is a measure of how much motor and crying activity the infant gives off to the observer at his peaks of excitement, and responsiveness pulls him toward the mean. The kind of intense reactions which some infants demonstrate when they reach their peak of excitement shows an unavailability to the outside world, and must be scored high. Others are hardly able to be jogged to respond at all, and their peak is very low. An average and optimal response would fall in the moderate, reachable range, in which the infant could be brought to respond to stimuli in spite of a high degree of upset or excitement, but then return to more moderate states.

1 - Low level of arousal to all stimuli. Never above state 2, does not awaken fully.
2 - Some arousal to stimulation--can be awakened to state 3.
3 - Infant reaches state 4 briefly, but predominantly is in lower states.
4 - Infant is in state 5 after stimulation.
5 - Infant reaches state 6 after stimulation once or twice, but predominantly is in state 5 or lower.

6 - Infant reaches state 6 after stimulation, but returns to lower states spontaneously.
7 - Infant reaches state 6 in response to stimuli, but with consoling is easily brought back to lower states.
8 - Infant screams (state 6) in response to stimulation, although some quieting can occur with consoling, with difficulty.
9 - Infant achieves insulated crying state. Unable to be quieted or soothed.

18. Rapidity of Buildup (from 1,2 to 6)

This is a measure of use of states from quiet to agitated state. It measures the timing and the number of stimuli which are used before he changes from his initially quiet state to a more agitated one. Since this implies that we start with an initially quiet baby, it measures the period of "control" which he can maintain in the face of increasingly aversive stimuli as well as the additive effect of these stimuli in changing his initially quiet state. The first preference is when one can observe the infant as he changes from a sleep state or a quiet awake one (5) to an agitated crying state (6).

1 - No upset at all.
2 - Not until TNR, Moro, prone placement and defensive reactions.
3 - Not until TNR, Moro, prone placement or defensive reactions.
4 - Not until pulled to sit.
5 - Not until undressed.
6 - Not until pinprick.
7 - Not until uncovering him.
8 - At first auditory and light stimuli.
9 - Never was quiet enough to score this.

19. Irritability (3,4,5)

This measures the number of times he gets upset as well as the kind of stimuli which make him cry. Since the presentation of the stimuli is fairly set but some may bring about crying, others even more aversive may not, we have tried to make the scores flexible by counts of number of aversive stimuli.

Aversive Stimuli

uncover
undress
pull to sit
prone
pinprick
TNR
Moro
defensive reaction

1 - No irritable crying to any of the above.
2 - Irritable crying to one of the stimuli.
3 - Irritable crying to two of the stimuli.
4 - Irritable crying to three of the stimuli.
5 - Irritable crying to four of the stimuli.
6 - Irritable crying to five of the stimuli.
7 - Irritable crying to six of the stimuli.
8 - Irritable crying to seven of the stimuli.
9 - To all of them.

20. Activity (alert states)

This is a summary of the activity seen during the entire observation especially during the alert states. The activity consists of two kinds - (1) spontaneous, and (2) in response to the stimulation of handling and the stimuli used by the observer. A further dimension is reflected in the inaccessibility of the activity in a hyperactive child--viz. the activity is not interfered with by the observer's maneuvers. Amount of activity is graded: much = 75% or more of the time, moderate refers to 50% of the time, slight = 25% of the time. After stimulation which triggers activity, the amount of activity which persists can be assessed; much, builds up first, perpetuates itself for a period after activity is initiated; average, no buildup, and at least 3 cycles of activity which is decreasing all the time; little, 2 or 3 cycles of activity which die out quickly.

	SPONTANEOUS	ELICITED
1	none	none
2	none	brief
3	slight	little
4	moderate	little
5	moderate	moderate
6	moderate	much
7	much	much
8	continuous	consolable
9	continuous	unconsolable

There may be a more marked difference between spontaneous and elicited than this scale reflects. Then, he should be scored midway between them, and the examiner should be alert to the fact that this reflects a kind of discoordination, such as is seen in metabolic imbalance or CNS irritation.

21. Tremulousness (all states)

Since this may be a measure of CNS irritation or depression, and may occur for metabolic reasons, or since it may be a sign of immaturity, it becomes one more way of assessing all of these. Tremulousness is demonstrated at the end of a startle, and as a baby comes from sleeping to awake states. There is some tremor of the chin and extremities which can be expected in the neonate's first week. As the infant is dehydrated normally in the second and third day, metabolic imbalances cause tremulousness. In light sleep or as he startles in deep sleep, tremors of the extremities are noted. As he becomes alert and active, the tremulousness should be overcome with smooth, voluntary behavior of the limbs. Aversive stimuli set off a startle which is followed by a return of tremulousness of the chin and extremities. Mildly aversive stimuli should not cause observable tremors in their reactions (see introduction for lists of aversive stimuli). Quivering and tremors are synonymous.

1 - No tremors or tremulousness noted.
2 - Chin quivering only during sleep.
3 - Chin quivering and brief tremors of extremities only during sleep.
4 - Chin and extremities quiver in response to one aversive stimulus.
5 - Quivering with first presentation of aversive stimulus and/or with crying.
6 - Quivering with some aversive stimuli and/or with state changes.
7 - Quivering with most aversive stimuli, some mildly aversive stimuli and/or with state change.
8 - Tremors with some state changes and/or with all aversive and mildly aversive stimuli.
9 - Tremulousness with all stimuli and also with all self-initiated activity.

22. Amount of Startle during Exam (3-6)

Both spontaneous startles and those which have been elicited in the course of stimulation are included in this. Some infants never startle during an exam, except when a Moro is elicited. Abnormally sensitive infants overreact to any disturbing stimulus with a startle, and have observable startles for no observable reason--hence they must be considered "spontaneous" or due to internal stimuli.

1 - No startles noted.
2 - Startle as a response to the Examiner's attempts to set off a Moro reflex--only.
3 - Startles to two aversive stimuli (including Moro).

4 - One spontaneous startle and at least one aversive stimulus beside a Moro.
5 - Startles to (3) aversive stimuli at the first presentation.
6 - One spontaneous startle and/or startle responses to aversive stimuli.
7 - Several spontaneous startles and/or startling to all aversive stimuli.
8 - Startles to all stimuli which Examiner presents (aversive and mildly aversive).
9 - Startles to self-initiated stimuli and/or to all of Examiner's presented stimuli.

23. Lability of Skin Color (as infant moves from 1 to 5)

This measures the changes of color and vascularity which take place in a period of exam, e.g., the acrocyanosis of peripheral mild cyanosis when the extremity is left uncovered, the change from pink to pale or purple when the baby is undressed--mottling and a web-like appearance may occur in an effort to maintain body heat. A normal newborn is likely to demonstrate mild color changes several times in an exam during which he has been undressed, disturbed, and upset. This should be assessed in particular as the infant comes from a sleep state 1 to 5. The length of time after undressing before he begins to change color is a good way to determine this. Additionally, the frequency-degree of change should be scored. No change in color may be the result of depressed or overstressed autonomic and vascular system, as seen in dopey, pale, or cyanotic infants. Marked changes which vary from minute to minute would be seen in prematures or babies who were not yet adjusted to extrauterine temperature changes, or in infants whose central and autonomic nervous systems were unable to master the changes during an exam.

Acrocyanosis should be indicated when there is more than mild, localized cyanosis of the extremities or around the mouth, and especially when the infant is not in enough stress to account for such mild changes.

Paling should be checked when paleness is unusual or excessive.

Reddening might be the result of unusual vascular changes, dehydration, or skin irritation.

Any other skin abnormality should be recorded as it might reflect metabolic or hematologic variations, which could influence the behavioral outcome of the exam.

1 - Pale, cyanotic and does not change during exam.
2 - Good color which does not change during entire exam.

3 - Healthy skin color, no change except change to blue around mouth, or extremities when uncovered or red when crying, recovery is rapid.
4 - Acrocyanosis around mouth and extremities when undressed, slight change in chest or abdomen but rapid recovery.
5 - Healthy color but changes color all over when uncovered or crying; face, lips, extremities may pale or redden, mottling may appear on face, chest, limbs; original color returns quickly.
6 - Change in color during exam, but color returns with crying or covering.
7 - Healthy color at outset, changes color to very red or blue when uncovered or crying; recovers slowly if covered or soothed.
8 - Good color which rapidly changes with uncovering; recovery is slow but does finally recover, when dressed.
9 - Marked, rapid changes to very red or blue, no recovery to good color during rest of exam.

24. Lability of States (all states)

This measures the infant's state performance over the exam period. Frequency of state changes over a recognizable, wide swing are counted. (Sleep to awake, crying to alert, sleep to crying, crying to sleep.) Counting should include changes upward and downward over the exam period of 30 minutes. In the event an exam does not take 30 minutes, prorate it to half an hour by using the formula,

Score = state change, X 30, divided by the length of exam in minutes.

The score corresponds to the frequency of swings:

1 = 1-2 swings as prorated
2 = 3-5
3 = 6-8
4 = 9-10
5 = 11-13
6 = 14-15
7 = 16-18
8 = 19-22
9 - 23 on up.

25. Self Quieting Activity (6,5 to 4,3,2,1)

This is a measure of activity which the baby initiates in a fussing state in an observable effort to quiet himself. The number of activities which can be observed is counted. Their success is measured by an observable state change which persists for at least 5 seconds. Most United States babies cry or fuss vigorously at some time during the exam (state 6). For those who never do cry, the supplementary score can be used, measuring the same number of efforts. If none, NA can be used. The activities which can be counted are: (1) hand to mouth efforts (2) sucking on fist or tongue (3) using visual or auditory stimulus from the environment to quiet himself (more than a simple response is necessary to determine this).

1 - Cannot quiet self, makes no attempt, and intervention is always necessary.
2 - Brief attempts to achieve hand to mouth as if to quiet self, but no success.
3 - Attempts to bring hand to mouth, and/ or quiets briefly.
4 - Brings hand to mouth, attempts to suck on fist but without success, quiets for a short time perceptibly.
5 - Makes at least two attempts to suck on hand or fist and/or has two successful brief quieting periods.
6 - Two attempts to quiet self result in observable successful quieting for periods.
7 - Repeats hand to mouth, sucking and/or uses visual or auditory stimuli to quiet self for three successes, but all are brief.
8 - Uses maneuvers to quiet self three times for short sustained periods.
9 - Consistently quiets self for sustained periods.

26. Hand to mouth facility (all states)

This is measured in all states. A hand to mouth reflex is inborn, and seems to be a response to stroking the cheek or the palm of the infant's hand. It can be triggered off by mucous and gagging in the neonate, by discomfort, by placing him in prone. It is seen spontaneously as the neonate attempts to control himself or comfort himself when upset. This is a measure of his ability to bring his hands to his mouth in supine as well as his success in insertion. Some infants bring their hands to their mouths repeatedly, insert a part of the fist or fingers, and suck actively on the inserted part.

1 - No attempt to bring hands to mouth.
2 - Brief swipes at mouth area, no real contact.
3 - Hand brought to mouth and contact, but no insertion, once only.

4 - Hand brought next to mouth area twice, no insertion.
5 - Hand brought next to mouth area at least 3 times, but no real insertion, abortive attempts to suck on fist.
6 - One insertion which is brief, unable to be maintained.
7 - Several actual insertions which are brief, not maintained, abortive sucking attempts, more than three times next to mouth.
8 - Several brief insertions in rapid succession in an attempt to prolong period, sucking at this time.
9 - Fist and/or fingers actually inserted and sucking on them for 15 seconds or more for several brief insertions.

27. Smiles (all states)

Smiles are seen in the neonate. They surely can be of reflexive grimacing in nature, and they also occur "appropriately"--or in response to soft auditory and/or visual cues. Occasionally, when the baby is handled and restrained in a cuddling position, a smile comes across his face as he relaxes. I have seen close replicas of "social smiles" in the newborn period--when an examiner leans over his crib and talks softly to him. They are difficult to be sure of, may consist primarily of a softening and brightening of the infant's face with a reflex grimace thrown in, and they may certainly be difficult to reproduce. Hence, one hesitates to call these social "smiles," but they surely are the facial precursors of such smiling behavior. A mother reinforces them as such.

Elicited Reflexes

These are described in Prechtl and Beintema's monograph (11) and need not be described here. Their procedure is followed for eliciting the 16 reflexes listed. Since this is not designed to be a neurological assessment, these will serve as baseline data for a more formal neurological where it is indicated. This manual scores:

X = omitted.
O = reflex not able to be elicited despite several attempts.
L = hypoactive response.
M = normal response as determined by Prechtl's manual (11).
H = hyperactive response.
A = asymmetrical response, either in terms of lateralization or segments of body (arms vs. legs, etc.). Since this may be of importance in assessing neurological damage, real, repeated asymmetry should be carefully assessed and noted, to be followed by a formal neurological assessment.

Examples of our use of these reflexes are:

Crawling includes all of the prone responses; head-lifting and head-turning, crawling, hand-to-mouth in prone.

Tonic deviation of head and eye is an 8th nerve response to being rotated in front of the examiner. He is held under both arms; then, examiner and infant rotate slowly in a circle. Eyes and head go ahead of examiner, then nystagmus of the eyes begins to occur, both in response to an 8th nerve compensatory reaction and as the eyes catch the passing light while they rotate.

Passive Movements of Arms and Legs (4,5)

As defined in Andre Thomas, Chesni and D'Argassies, The Neurological Exam of the Infant (10), this becomes a measure of consistency and extensibility of muscle tone, in reaction to passive stretching of the limbs as well as the amount and degree of recoil of the limb after extension. As a summary of these in all the limbs and the trunk, it represents the muscle tone of the body plus its reaction to stimulation. A big, floppy baby may have no resistance to stretching of his limbs. A very tense, jittery infant will be very resistant to being moved, and limbs will snap back into flexion after being stretched. Infants normally show some resistance to having their extremities stretched, and a little snapback is normal. The degree to which limbs must be extended (up to full extension) in order to meet resistance, as well as the amount of snapback (which measures the overreaction of flexor muscles) is scored. Legs are usually more resistant to extension than arms, and very few infants do not attempt to maintain tone of their legs against stretching. Inequality of the two sides is a very important part of this assessment. (See Prechtl (11).)

Descriptive Paragraph (optional)

Descriptive Scores (optional)

This is a summary of all the subjective impressions which have been amassed in the period. They include the style with which the infant reacts, the examiner's major impressions about the infant, his feelings about the appearance and behavior of the infant, his predictions about the kind of responses these will call up in his mother, as well as predictions about their ultimate outcome as the child grows. This will be the paragraph which will help the examiner to remember the child later, and may be an important way of categorizing infants, or understanding the scores in the different categories, and of understanding meaningful constellations of these categories. This is not expected to be subject to interscorer reliability.

The subjective reaction of the E is subsumed under "attractive" in an attempt to objectify this.

Interfering variables such as light, noise, too many observers, etc. should be scored and listed.

Need for stimulation scores the result of the infant's observable responses. Some infants seem to need stimulation from outside himself in order to function smoothly and well. These infants would score high on this measure. Others seem to pay little attention to outside stimulation, respond automatically. They deserve a low score.

The kind of activity which the infant uses characteristically to quiet himself has been of some interest to many observers. This can be checked and/or scored on a 3 point scale.

Comments: Write a descriptive paragraph about the baby which includes the particular characteristics which are of interest in your study. This paragraph serves as a reminder of the unique characteristics of the baby which are not recordable elsewhere.

APPENDIX C

APPENDIX C

BEHAVIORAL AND NEUROLOGICAL ASSESSMENT SCALE
Revised Edition: Aug. 1971
(T. Barry Brazelton)

name ____________________ Sex ____ Age ____ Born ______________
Date Hour

r's Age __________ Father's Age ____ Father's S.E.S. ______________
Apparent Race ______________

iner(s) ________________ Hospital

itions of examination: Date ____________

Birth Weight ______ Current weight ______ Age at Testing ______________

Time Examined ______ Time last fed ______ Type of feeding ____________

Duration of Exam
mation from Chart: ____________

Type of delivery ______________ Apgar ________________
Length of labor ______________ Birth order ____________
Type, amount and timing of medication given Mother ______________
____
Anesthesia ________________
Abnormalities ________________

EXAMINATION

ial State: observe 2 minutes (Prechtl's scoring)

1	2	3	4	5	6
deep	light	drowsy	moderate	alert	crying

minate states (mark two)

1	2	3	4	5	6

Elicited movements

	X	O	L	M	H	D	A
ing			1	2	3		
ski			1	2	3		
grasp			1	2	3		
ar grasp			1	2	3		
e clonus			1	2	3		
			1	2	3		
ling			1	2	3		
			1	2	3		
rvation			1	2	3		
ills			1	2	3		
deviation head eyes			1	2	3		
gmus during tation			1	2	3		
			1	2	3		
			1	2	3		
stence Arms L			1	2	3		
R			1	2	3		
Legs L			1	2	3		
R			1	2	3		

Descriptive Paragraph

Attractive	0	1	2	3
Interferring variables	0	1	2	3
Need for stimulation	0	1	2	3

What activity does he use to quiet self.

hand to mouth
sucking with nothing in mouth
locking onto visual or auditory stimuli
postural changes
state change for no observable reason

COMMENTS:

Scale									
Response decrement to light (2,3)									
Response decrement to rattle (2,3)									
Response decrement to bell (2,3)									
Response decrement to pinprick									
Orientation inanimate visual (4 only)									
Orientation inanimate auditory (4,5 states)									
Orientation animate visual (4 only)									
Orientation animate auditory (4,5)									
Orientation animate visual & auditory (4 only)									
Alertness									
General tonus									
Motor maturity (4,5)									
Pull-to-sit (3,5)									
Cuddliness (4,5)									
Defensive movement (4)									
Consolability (6 to 5,4,3,2)									
Peak of excitement (6)									
Rapidity of buildup (from 1,2 to 6)									
Irritability (3,4,5)									
Activity (alert states)									
Tremulousness									
Startle									
Lability of skin color									
Lability of state									
Self-quieting activity									
Hand-mouth facility									
Smiles									

APPENDIX D

THE UNIVERSITY OF KANSAS
LAWRENCE, KANSAS 66044

Department of Human Development

ea arent:

APPENDIX D

e Infant Research Program is part of the Kansas Center for Research in Early Childhood ucation at the University of Kansas. We are ultimately interested in understanding what e the best experiences for individual children so that each child can be helped to enjoy timal development. As part of this effort we are engaged in working on the development a behavioral scale for newborn infants.

ministering the scale involves taking the infant in his own basinette to a quiet room where is examined by experienced personnel. Hospital procedures of scrubbing and gowning e followed prior to each infant examination. The examination procedures have been re- ewed and approved by your doctor. A description of those procedures is provided for ur information.

e are now testing a number of the babies born in this hospital. If you are willing to have ur baby examined in the hospital, please sign at the bottom. Your cooperation in this atter will be greatly appreciated. We are hopeful that our research and the work of hers around the country will lead us to a better understanding of how children grow and arn. We shall then be able to help all children reach their full potential. The willingness parents to have their babies participate in a program such as this will bring us nearer that goal.

Thank you very much,

Frances Degen Horowitz, Ph.D.
Professor in Human Development and
Psychology

): Stormont-Vail Hospital

ave read the above letter and the description of the examination procedures contained on reverse side, and I consent to the examination of my baby by authorized persons from University of Kansas Infant Research Program.

understand that while the hospital is cooperating with the Department of Human Development, iversity of Kansas, by allowing the use of hospital facilities, the examination is not done hospital employees, nor is the hospital responsible therefor.

urther understand that certain information concerning my child will be obtained from the spital records, and I authorize Stormont-Vail Hospital to release the requested information medical record and my baby's medical record.

ted ____________________

tness: ____________________ Signature

APPENDIX E

The numbers from one to twenty-seven in the following figures represent the following Brazelton Scale Items:

1 - Response decrement to light
2 - Response decrement to rattle
3 - Response decrement to bell
4 - Response decrement to pinprick
5 - Orientation inanimate - visual
6 - Orientation inanimate - auditory
7 - Orientation animate - visual
8 - Orientation animate - auditory
9 - Orientation animate - visual and auditory
10 - Alertness
11 - General Tonus
12 - Motor Maturity
13 - Pull to sit
14 - Cuddliness
15 - Defensive movement
16 - Consolability
17 - Peak of excitement
18 - Rapidity of build up
19 - Irritability
20 - Activity
21 - Tremulousness
22 - Startle
23 - Lability of skin color
24 - Lability of state
25 - Self quieting activity
26 - Hand-mouth facility
27 - Smiling

APPENDIX E
TABLE 1

DAY ONE

BRAZELTON ITEMS CORRELATED WITH DAYS 2, 3, 4, 5, 7, 10 AND 28

ITEMS	1	2	3	4	5	6	7	8	9	10	11	12	13
1											.34*		
2			.73***							.32*			
3				.34*									
4													
5						.41***	.64***		.57***	.60***			
6							.44**	.70***	.35*	.58***			
7								.45**	.48**	.60***			
8									.49***	.49***			
9										.56***	.35*		
10													.54***
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													

DAY ONE (continued)

ITEMS	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1			-.34*				.31*							
2														
3														
4			-.33*											
5														
6														
7														
8	.30*													
9														
10														
11														
12							.37*					.37*		
13														
14														
15														
16				-.53***										
17						.60***					[illegible]			
18						.59***					.35*			.32*
19											.66***			
20														
21														
22														
23														
24														
25														
26														
27														

DAY ONE

MEANS AND STANDARD DEVIATIONS

ITEM	MEAN
1	7.68
2	7.05
3	7.98
4	5.07
5	4.07
6	4.59
7	5.23
8	5.52
9	5.30
10	4.11
11	4.59
12	3.98
13	4.18
14	5.20
15	4.50
16	7.07
17	5.80
18	4.48
19	3.50
20	4.02
21	3.39
22	2.95
23	5.20
24	4.32
25	5.61
26	4.43
27	0.57

ITEM	STANDARD DEVIATION
1	2.22
2	2.23
3	2.10
4	2.24
5	2.69
6	2.07
7	2.50
8	1.69
9	3.32
10	3.04
11	1.22
12	1.28
13	1.81
14	1.47
15	2.46
16	2.59
17	1.36
18	1.81
19	1.73
20	1.34
21	2.36
22	1.61
23	1.84
24	2.22
25	3.19
26	2.64
27	0.85

APPENDIX E
TABLE 2

DAY TWO

BRAZELTON ITEMS CORRELATED WITH DAYS 1, 3, 4, 5, 7, 10 AND 28

ITEMS	1	2	3	4	5	6	7	8	9	10	11	12	13
1		.43***	.40**										
2			.78***										
3													
4													
5						.68***	.68***		.73***	.51***			
6							.58***	.37**	.80***	.55***			
7								.45**	.91***	.73***	.38*		
8									.43**	.46**			
9										.74***			
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													

DAY TWO (continued)

ITEMS	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1														
2			-.30*	.31*										
3			-.36*		.42**			-.33*						
4														
5														
6														
7														
8														
9														
10	.34*					.36*			.33*				-.36*	
11							.50***							
12								-.55***					-.38*	
13														
14									.34*					
15														
16						-.42**								
17						.54***	.34*				.49***			
18						.41**								
19							.40**				.66***			
20								.31*						
21									.43**					
22										.39**				
23														
24														
25														
26														-.30*
27														

DAY TWO

MEANS AND STANDARD DEVIATIONS

ITEM	MEAN
1	7.09
2	7.59
3	7.68
4	4.27
5	4.55
6	4.50
7	5.20
8	5.34
9	5.39
10	4.23
11	4.84
12	3.68
13	4.02
14	4.66
15	5.05
16	6.41
17	5.95
18	5.30
19	4.61
20	4.27
21	4.09
22	3.32
23	4.91
24	5.16
25	4.86
26	4.25
27	0.50

ITEM	STANDARD DEVIATION
1	2.80
2	2.16
3	2.36
4	1.96
5	2.42
6	1.81
7	2.15
8	1.43
9	2.16
10	2.12
11	0.91
12	1.12
13	1.65
14	1.40
15	2.33
16	2.43
17	1.70
18	1.58
19	1.71
20	1.42
21	2.31
22	1.58
23	1.90
24	2.11
25	2.81
26	2.57
27	0.84

APPENDIX E
TABLE 3

DAY THREE

BRAZELTON ITEMS CORRELATED WITH DAYS 1, 2, 4, 5, 7, 10 AND 28

ITEMS	1	2	3	4	5	6	7	8	9	10	11	12	13
1		.45**	.46**		.32*			.32*					
2			.70***										.48**
3													
4													
5						.62***	.80***	.47**	.78***	.62***			
6							.40*	.54***	.35*	.33*			
7								.60***	.92***	.77***	.40**	.36*	
8									.54***	.50***		.36*	
9										.73***	.47**	.42**	
10											.54***	.39**	.36*
11													.31*
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													

DAY THREE (continued)

ITEMS	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1														-.43**
2														
3														-.42**
4														
5		.30*												
6		.42**					.35*							
7		.42**												
8	.37*	.47**		.31*			.31*							
9		.42**												
10	.33*	.44**					.33*			.31*				
11	.38*	.45**					.48**							
12	.41**	.33*					.36*							
13												.30*		
14													-.34*	
15							.37*						.33*	
16				-.70***	-.42**	-.61***	-.37*				-.33*	-.30*		
17					.48***	.60***	.48**	.35*			.52***			
18						.74***	.39**							
19							.47***				.52***			
20														
21									.40**					
22														
23														
24														
25														
26														
27														

DAY THREE

MEANS AND STANDARD DEVIATIONS

ITEM	MEAN
1	7.43
2	7.61
3	7.80
4	4.82
5	4.52
6	4.45
7	5.34
8	5.39
9	5.64
10	4.57
11	4.82
12	3.77
13	4.73
14	5.00
15	6.05
16	5.57
17	6.36
18	4.50
19	4.27
20	4.52
21	4.02
22	3.27
23	4.50
24	4.52
25	4.84
26	4.89
27	0.48

ITEM	STANDARD DEVIATION
1	2.22
2	2.03
3	1.77
4	2.13
5	2.57
6	1.95
7	2.51
8	1.84
9	2.49
10	2.42
11	1.17
12	1.58
13	1.96
14	1.61
15	2.18
16	2.73
17	1.56
18	1.52
19	1.77
20	1.68
21	2.18
22	1.58
23	1.95
24	1.76
25	2.52
26	2.09
27	0.82

TABLE 4

DAY FOUR

BRAZELTON ITEMS CORRELATED WITH DAYS 1, 2, 3, 5, 7, 10 AND 28

ITEMS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1		.44**												
2			.57***											
3				.32*										
4														
5						.70***	.61***	.52***	.60***	.63***	.33*			
6								.50***	.31*	.58***	.40*			
7								.70***	.77***	.65***				
8									.49***	.58***			.47**	
9										.63***				
10											.53***		.38**	
11												.31*	.30*	
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														

DAY FOUR (continued)

ITEMS	15	16	17	18	19	20	21	22	23	24	25	26	27
1													
2													
3	.33*				.31*								
4				.33*	.32*								-.31*
5			-.37*									.42**	
6			-.34*										
7			-.33*			.34*						.30*	
8													
9			-.42**			.34*							
10			-.40**			.48**					.33*	.39**	
11	.33*												
12												.32*	
13													
14													
15											.30*		
16													
17										.37*			
18					.63***					.47**			
19										.49***			-.41**
20													
21								.34*					
22													
23													
24											-.35*	-.40**	
25												.57***	
26													-.36*
27													

DAY FOUR

MEANS AND STANDARD DEVIATIONS

ITEM	MEAN
1	7.50
2	7.59
3	7.86
4	5.00
5	3.77
6	4.48
7	5.43
8	5.57
9	5.43
10	4.39
11	4.98
12	3.89
13	4.40
14	5.27
15	6.18
16	5.75
17	6.05
18	4.57
19	4.25
20	4.98
21	3.50
22	3.22
23	4.98
24	4.77
25	5.32
26	5.00
27	0.93

ITEM	STANDARD DEVIATION
1	2.40
2	2.21
3	2.14
4	2.49
5	2.53
6	2.09
7	2.40
8	1.76
9	2.27
10	2.12
11	1.05
12	1.77
13	1.86
14	1.21
15	1.78
16	2.40
17	1.63
18	1.58
19	1.75
20	1.37
21	2.15
22	1.67
23	1.61
24	2.05
25	2.58
26	2.60
27	1.68

APPENDIX E
TABLE 5

DAY FIVE

BRAZELTON ITEMS CORRELATED WITH DAYS 1, 2, 3, 4, 7, 10 AND 28

ITEMS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1		.65***	.51***	.40**										
2			.88***	.39**									-.39**	
3				.34**									-.37*	
4											-.32*			
5						.46**	.52***	.31*	.50***					
6							.66***	.55***	.69***	.68***	.30*			.34*
7								.73***	.94***	.69***	.35*		.33*	
8									.71***	.60***	.51***	.41**	.39**	.41***
9										.69***	.35*		.39**	.33*
10											.35*	.33*	.35*	.50***
11												.62***	.47**	.38*
12													.38*	.62***
13														.31*
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														

DAY FIVE (continued)

ITEMS	15	16	17	18	19	20	21	22	23	24	25	26	27
1											-.39**		-.38*
2	-.33*					-.36*							
3	-.41**					-.30*							
4					-.37*								
5	.41**												
6	.37*											.48***	
7	.42**					.40*							
8	.33*		.31*	.32*		.37*					.31*		
9	.40**					.39**						.33*	
10	.48**					.50***						.35*	.35*
11	.33*		.31*	.33*		.53***					.36*		
12						.39**	-.30*					.30**	
13	.38*					.56***							
14											.33*		.33*
15					.48**	.55***						.43**	
16			-.65***		-.50***					-.55***			.32*
17				.42**	.57***	.32*				.74***			
18					.33*					.51***		.35*	
19						.43**			.34*	.51***		.42**	
20											.34*	.40**	
21													
22									.32*				
23											.47**		
24													
25													.48***
26													
27													

DAY FIVE

MEANS AND STANDARD DEVIATIONS

ITEM	MEAN
1	8.00
2	7.95
3	8.02
4	5.93
5	4.86
6	4.48
7	5.89
8	5.39
9	5.70
10	4.57
11	4.98
12	4.34
13	3.98
14	4.80
15	5.66
16	5.75
17	6.05
18	4.34
19	3.80
20	4.84
21	2.84
22	2.58
23	4.50
24	4.68
25	4.86
26	4.57
27	0.70

ITEM	STANDARD DEVIATION
1	2.19
2	2.01
3	2.03
4	2.93
5	2.55
6	2.24
7	2.34
8	1.85
9	2.39
10	1.88
11	1.17
12	1.67
13	1.97
14	1.62
15	2.67
16	2.53
17	1.85
18	2.05
19	1.96
20	1.46
21	2.03
22	1.51
23	1.98
24	2.27
25	2.88
26	2.59
27	1.23

TABLE 6

DAY SEVEN

BRAZELTON ITEMS CORRELATED WITH DAYS 1, 2, 3, 4, 5, 10 AND 28

ITEMS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1		.67***	.65***	.46**										-.35*
2			.75***											
3				.38*										
4												-.37*		-.39**
5						.44**	.73***	.50***	.67***	.66***	.41**			
6							.39**	.41**			.42**			
7								.56***	.78***	.69***	.43**			
8									.49***	.54***	.44**	.41**		
9										.66***	.36*			
10														.32*
11													.45*	.47**
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														

DAY SEVEN (continued)

ITEMS	15	16	17	18	19	20	21	22	23	24	25	26	27
1													-.37*
2				.35*	.31*					.30*			
3													
4								-.32*	-.43**				
5						.41**						.49**	
6			.35*		.32*	.39**						.31*	
7						.42**						.42**	
8			.35*			.37*			.40**		.35*	.34*	
9						.43**						.42**	
10						.41**					.44**	.46**	
11	.31*		.49*	.34*	.34*	.48**		.38*		.33*		.36*	
12									-.31*				
13	.39**	-.45**	.42*	.40**	.38*	.43**		.30*		.36*			-.33*
14								.33*	.30*				.35*
15			.33*		.34*					.33*			
16													
17				.70***	.64***	.38**			.44**	.75***			
18					.84***			.33*	.36*	.57***			-.33*
19										.57***			-.35*
20												.46**	
21								.34*					
22													
23										.32*			
24													
25													.50***
26													.33*
27													

DAY SEVEN

MEANS AND STANDARD DEVIATIONS

ITEMS	MEAN
1	7.40
2	7.59
3	7.61
4	4.90
5	5.02
6	5.00
7	5.84
8	5.82
9	5.95
10	5.32
11	4.82
12	4.32
13	4.84
14	4.90
15	5.57
16	5.73
17	5.84
18	3.77
19	3.39
20	4.70
21	3.07
22	2.64
23	4.49
24	4.32
25	5.70
26	3.86
27	1.09

ITEMS	STANDARD DEVIATION
1	2.53
2	2.37
3	2.54
4	2.46
5	2.20
6	1.78
7	2.07
8	1.53
9	2.21
10	2.22
11	1.15
12	1.34
13	1.89
14	1.70
15	2.42
16	2.53
17	1.57
18	1.93
19	1.66
20	1.42
21	2.08
22	1.24
23	1.74
24	2.07
25	2.89
26	2.30
27	1.80

DAY TEN

BRAZELTON ITEMS CORRELATED WITH DAYS 1, 2, 3, 4, 5, 7 AND 28

ITEMS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1		.85***	.71***	.46**										
2			.72***	.43**										
3														
4														
5						.59***	.52***	.50***	.68***	.50***	.32*	.35*	.42**	.30*
6							.52***	.68***	.53***	.44**	.31*	.46**	.37*	.37*
7								.67***	.85***	.63***	.32*	.60***	.55***	.37*
8									.75***	.57***	.31*	.58***	.43**	.48**
9										.75***	.40**	.67***	.55***	.55***
10												.71***	.32*	.63***
11												.37*	.44**	.32*
12													.37*	.52***
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														

DAY TEN (continued)

ITEMS	15	16	17	18	19	20	21	22	23	24	25	26	27
1							-.34*						
2													
3													
4					-.32*			-.47***					
5	.63***										.41**		
6	.58***					.38*					.39**		
7	.51***								.36*		.44**		.31*
8	.66***					.35*			.46**		.56***		
9	.64***										.41**		
10	.54***										.40**		.33*
11	.44**					.51***							
12	.43**					.34*							.32*
13	.48**					.48**			.40**				
14	.44**					.39**					.39**		.32*
15				-.31*		.59***			.40**		.43**		
16													
17				.71***	.63***		.34*			.56***		.35*	-.35*
18					.59***					.46**			-.31*
19									.40**	.59***			-.37*
20							.35*		.46**				
21										.37*			
22													
23										.36*			
24													
25													.45**
26													
27													

DAY TEN

MEANS AND STANDARD DEVIATIONS

ITEMS	MEAN
1	8.11
2	8.04
3	7.98
4	6.09
5	5.25
6	5.07
7	6.14
8	5.57
9	6.23
10	5.57
11	4.80
12	4.09
13	4.55
14	4.77
15	6.34
16	6.43
17	5.60
18	4.16
19	3.30
20	4.57
21	2.89
22	2.50
23	4.43
24	4.09
25	5.57
26	3.60
27	1.00

ITEMS	STANDARD DEVIATION
1	2.35
2	2.24
3	2.43
4	2.44
5	2.11
6	1.55
7	2.14
8	1.50
9	1.90
10	2.41
11	1.11
12	1.51
13	1.74
14	1.50
15	2.40
16	2.97
17	1.94
18	2.37
19	2.14
20	1.26
21	2.01
22	1.15
23	1.69
24	2.36
25	3.19
26	2.23
27	1.56

DAY TWENTY EIGHT

BRAZELTON ITEMS CORRELATED WITH DAYS 1, 2, 3, 4, 5, 7 AND 10

ITEMS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1		.72***	.68***	.35*										
2			.94***	.34*										
3														
4														
5						.62***	.56***	.38*	.62***	.52***				
6							.47**	.40**	.51***	.55***	.30*	.30*	.34*	.31*
7								.72***	.85***	.80***	.37*	.47**		.36*
8									.75***	.67***	.30*	.36*	.36*	.32*
9										.81***	.45**	.51***		.34*
10												.61***		.38*
11												.40**	.35*	
12														.35*
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														

DAY TWENTY EIGHT (continued)

ITEMS	15	16	17	18	19	20	21	22	23	24	25	26	27
1											-.34*		
2											-.32*		
3												-.50***	
4													
5	.36*												
6	.36*												
7	.52***					.46**	.37**	.36*					
8	.41**												
9	.57***					.40**			.30*				
10	.40**					.35*	.31*	.38*					.33*
11	.42**			.37*	.30*	.51***			.43**				
12	.48***					.41**							
13	.55***		.32*			.40**							
14										-.34*			
15						.40**							
16													
17				.47**		.53***				.53***			
18					.43**				.44**	.73***			
19									.51***	.36*		.41**	
20													
21													
22											.37*		
23										.34*			
24												.32*	
25												.34*	
26													
27													

DAY TWENTY EIGHT

MEANS AND STANDARD DEVIATIONS

ITEMS	MEAN
1	8.86
2	8.84
3	9.00
4	5.61
5	6.34
6	5.61
7	7.27
8	6.25
9	7.20
10	6.43
11	5.40
12	5.78
13	5.59
14	4.73
15	6.59
16	5.55
17	5.93
18	4.43
19	3.00
20	5.25
21	2.55
22	2.18
23	4.57
24	4.55
25	4.77
26	2.82
27	1.23

ITEMS	STANDARD DEVIATION
1	1.76
2	2.05
3	1.89
4	2.96
5	2.28
6	1.94
7	1.82
8	2.15
9	1.95
10	2.13
11	1.30
12	1.76
13	2.37
14	1.95
15	2.24
16	3.30
17	2.24
18	2.49
19	2.06
20	1.53
21	1.86
22	1.08
23	1.56
24	2.67
25	3.45
26	2.55
27	1.40

APPENDIX E
TABLE 9

SCALE RELIABILITY BY SUBJECT AND BY USING $\frac{A}{A+D}$ FORMULA TWO SCORES ADJACENT

	1-2	2-3	3-4	4-5	5-7	7-10	10-28	1-3	1-4	4-7	4-28	7-28	Individual Mean
Group 0													
	80	63	70	33	63	77	61	75	40	56	57	57	61
	83	63	69	64	76	81	77	78	81	68	65	77	74
	70	85	74	67	87	83	83	69	83	71	48	83	75
	93	78	79	60	60	61	39	81	62	57	65	63	67
	50	79	89	73	73	62	78	70	48	78	71	71	70
Means	75	74	76	59	72	73	68	75	63	66	61	70	
Group I	63	67	78	63	41	59	71	59	44	44	63	67	60
	70	74	75	63	68	74	78	74	63	79	65	74	71
	74	78	74	74	56	67	71	67	63	67	58	67	68
	59	70	71	83	65	70	78	63	96	57	61	77	71
		78	63	85	89					59	80	72	75
	67	54	79	83	88	91	92	71	78	92	70	67	78
	70	59	85	64	68	67	96	65	80	63	67	85	72
	68	74	67	75	78			77	79	74	42	50	63
	74	96	74	63	62	88	70	78	89	77	56	58	74
	78	74	63	52	85	82	86	63	88	65	43	77	71
	65	50	59	67	33	58	63	59	65	52	63	54	57
	85	46	65	88	96	87	87	46	75	92	75	83	77
	83	83	63	58	67	71	75	77	79	88	83	92	77
	77	73	73	72	44	82	50	85	73	58	45	57	66
	68	72	92	83	96	89	56	52	54	92	67	52	73
	71	88	64	64	61	59	71	71	61	70	67	77	70
	81	85	78	59	78	74	62	96	74	74	50	65	73
	74	85	83	74	65	74	77	81	74	68	90	68	76
	63	54	58	92	88	71	71	50	63	88	83	100	74
	71	78	91	92	96	52	87	70	67	65	77	50	75
Means	72	72	73	73	72	73	75	69	72	71	66	70	

TABLE 9 (continued)

	1-2	2-3	3-4	4-5	5-7	7-10	10-28	1-3	1-4	4-7	4-28	7-28	Individual Mean
Group II													
	67	61	91	81	92	79	63	70	71	78	56	67	73
	81	69	54	96	85	71	71	75	79	88	67	33	72
	73	77	61	69			54	70	78		79		70
	91	86	88	79	70	65	74	84	74	67	63	52	74
	63	81	74	74	81	67	67	48	78	74	50	71	69
	81	59	70	75	75	58	82	59	70	67	73	64	69
Mean	76	72	73	79	80	68	69	68	75	75	65	57	
Group III	75	85	69	77	77	81	96	75	67	69	71	92	78
	78	53	60	74	83	71	76	67	78	81	65	83	72
	70	81	85	79	59	83	64	63	67	83	92	50	73
	69	67	91	81	81	79	61	77	77	74	61	83	75
Mean	73	72	76	78	75	79	74	71	72	77	72	77	
Group IV	88	83	81	81	54	79	63	63	63	29	50	75	67
	92	83	100	77	93	81	64	48	54	81	64	87	73
	78	71	63	38	77	63	58	65	39	74	65	71	64
	75	67	81	82	57	79	79	79	70	65	57	83	73
	76	48	78	69	91	83	58	56	56	83	54	69	68
	69	58	74	59	54	88	63	63	70	85	78	65	69
	54	63	69	65	78	71	75	65	76	58	81	41	66
	92	81	84	100	87	74	86	68	84	73	88	74	83
	69	84	88	70	57	61	61	69	70	52	32	64	65
Mean	77	66	80	71	72	75	67	64	65	67	63	70	

APPENDIX F

APPENDIX F

TABLE 1

DAY ONE

STEMS	ITEMS	I	II	III	IV	V	VI	VII	VIII	IX	X	h^2
		FACTORS										
Habit. light	1							-.81				.79
Habit. rattle	2				-.87							.87
Habit. bell	3				-.85							.79
Pinprick	4									-.57		.72
Orient. inan. vis.	5	.76										.83
Orient. inan. aud.	6	.68										.80
Orient. an. vis.	7	.89										.89
Orient. an. aud.	8	.65										.80
Orient. an. vis. aud.	9	.85										.86
Alertness	10	.77										.75
Gen. Ton.	11			.80								.79
Motor Mat.	12					-.87						.86
Pull Sit	13			.77								.72
Cuddle	14						.88					.88
Def. mov.	15				.48							.61
Consol	16							.54				.70
Peak excitement	17		.74								.42	.85
Rapid bldup	18		.58						-.46			.81
Irrit.	19		.88									.83
Activ.	20			.54								.58
Tremul.	21									.60		.60
Startle	22									.77		.69
Lab. skin color	23						-.50			.50		.72
Lab. state	24		.86									.82
Self quiet	25					-.50	-.45					.82
Hand-mouth	26										-.84	.79
Smiles	27								-.84			.77

APPENDIX F

TABLE 2

DAY TWO

STEMS	ITEMS	I	II	III	IV	V	VI	VII	VIII	IX	IX	h^2
							FACTORS					
Habit. light	1				-.53							.62
Habit. rattle	2				-.89							.84
Habit. bell	3				-.90							.85
Pinprick	4							-.83				.75
Orient. inan. vis.	5	-.83										.86
Orient. inan. aud.	6	-.83										.72
Orient. an. vis.	7	-.90										.85
Orient. an. aud.	8	-.50				.44						.64
Orient. an. vis. and aud.	9	-.93										.90
Alertness	10	-.75										.82
Gen. Ton.	11								-.80			.74
Motor Mat.	12			.57								.74
Pull sit	13			.76								.65
Cuddle	14						.83					.77
Def. mov.	15										-.40	.48
Consol	16			.40								.74
Peak excitement	17		-.71									.72
Rapid. bldup	18							-.76				.71
Irrit.	19		-.70									.80
Activ.	20								-.75			.66
Tremul.	21			-.57								.74
Startle	22						.49				.53	.78
Lab. skin color	23										.87	.82
Lab. state	24		-.90									.84
Self-quiet	25					-.53						.45
Hand-mouth	26					-.79						.79
Smiles	27					.58						.70

APPENDIX F

TABLE 3

DAY THREE

STEMS	ITEMS	I	II	III	IV	V	VI	VII	VIII	h^2
						FACTORS				
Habit. light	1			-.68						.84
Habit. rattle	2			-.86						.80
Habit. bell	3			-.83						.75
Pinprick	4			-.42						.45
Orient. inan. vis.	5	.89								.87
Orient. inan. aud.	6	.64								.64
Orient. an. vis.	7	.92								.91
Orient. an. aud.	8	.68								.74
Orient. an. vis. and aud.	9	.89								.86
Alterness	10	.73								.83
Gen. Ton.	11							-.60		.60
Motor. mat.	12	.40			-.52					.62
Pull sit	13			.43						.68
Cuddle	14							-.87		.88
Def. mov.	15	.47						.48		.76
Consol	16		.68						-.48	.79
Peak excitement	17		-.82							.80
Rapid bldup	18		-.79							.77
Irrit.	19		-.85							.81
Activ.	20		-.55					-.50		.70
Tremul.	21				.70					.60
Startle	22				.74					.67
Lab. skin color	23						-.77			.70
Lab. state	24		-.72							.74
Self-quiet	25					-.66				.63
Hand-mouth	26					-.80				.80
Smiles	27			.46					-.68	.82

APPENDIX F

TABLE 4

DAY FOUR

		FACTORS									
STEMS	ITEMS	I	II	III	IV	V	VI	VII	VIII	IX	h^2
Habit. light	1				-.67						.72
Habit. rattle	2				-.84						.82
Habit. bell	3				-.72						.83
Pinprick	4										.70
Orient. inan. vis.	5	.84								.68	.86
Orient. inan. aud.	6	.65									.73
Orient. an. vis.	7	.85								-.45	.87
Orient. an. aud.	8	.77									.76
Orient. an. vis. and aud.	9	.80									.74
Alertness	10	.78									.84
Gen. Ton.	11	.41									.65
Motor mat.	12			.81				-.54			.84
Pull sit	13										.77
Cuddle	14							-.44	.43		.66
Def. mov.	15						.76				.59
Consol.	16		-.45			.49		-.71			.66
Peak excitement	17	-.49									.73
Rapid bldup.	18		.78								.72
Irrit.	19		.86								.85
Activ.	20										.73
Tremul.	21						.53				.82
Startle	22								.75		.76
Lab. skin color	23					-.81			.72		.74
Lab state	24		.54	-.62							.83
Self-quiet	25				.60						.75
Hand-mouth	26			.64			.44	-.43			.86
Smiles	27		-.65								.73

APPENDIX F

TABLE 5

DAY FIVE

		FACTORS								
STEMS	ITEMS	I	II	III	IV	V	VI	VII	VIII	h^2
Habit. light	1			.72			.49			.78
Habit. rattle	2			.94						.92
Habit. bell	3			.90						.87
Pinprick	4					.51				.69
Orient. inan. vis.	5	.64								.78
Orient. inan. aud.	6	.82								.80
Orient. an. vis.	7	.89								.86
Orient. an. aud.	8	.75								.81
Orient. an. vis. and aud.	9	.90								.87
Alertness	10	.72								.70
Gen. Ton.	11				.70					.69
Motor mat.	12				.82					.81
Pull sit	13				.63					.69
Cuddle	14				.62		-.42			.68
Def. mov.	15	.41				-.67				.72
Consol	16		.75							.67
Peak excitement	17		.83							.80
Rapid bldup	18		.66							.59
Irrit.	19		.59			-.66				.82
Activ.	20				.47	-.63				.78
Tremul.	21								.84	.82
Startle	22							.82		.80
Lab. skin color	23						-.41	.69		.77
Lab. state	24		.89			-.45				.86
Self-quiet	25						-.75			.75
Hand-mouth	26								-.54	.74
Smiles	27						-.80			.77

APPENDIX F

TABLE 6

DAY SEVEN

		FACTORS								
STEMS	ITEMS	I	II	III	IV	V	VI	VII	VIII	h^2
Habit. light	1			.82						.81
Habit. rattle	2			.89						.86
Habit. bell	3			.83						.81
Pinprick	4								.70	.76
Orient. inan. vis.	5	-.84								.82
Orient. inan. aud.	6						-.41			.65
Orient. an. vis.	7	-.88								.80
Orient. an. aud.	8	-.68								.76
Orient. an. vis. and aud.	9	-.87								.81
Alertness	10	-.82								.79
Gen. Ton.	11	-.46	-.42							.75
Motor. mat.	12								-.74	.76
Pull sit	13					-.56				.61
Cuddle	14				.79					.81
Def. mov.	15							.83		.77
Consol	16		.73							.80
Peak excitement	17		-.86							.85
Rapid bldup	18		-.79							.82
Irrit.	19		-.78							.85
Activ.	20	-.55								.65
Tremul.	21						-.84			.78
Startle	22						-.61			.69
Lab. skin color	23		-.53						-.54	.80
Lab. state	24		-.80							.76
Self-quiet	25					.60				.68
Hand-mouth	26	-.63			-.50					.83
Smiles	27				.43	.72				.86

APPENDIX F

TABLE 7

DAY TEN

STEM	ITEMS	FACTORS I	II	III	IV	V	VI	VII	VIII	h^2
Habit. light	1			.93						.91
Habit. rattle	2			.89						.84
Habit. bell	3			.83						.79
Pinprick	4			.44	-.68					.72
Orient. inan. vis.	5	-.88								.86
Orient. inan. aud.	6	-.75								.61
Orient. an. vis.	7	-.60								.82
Orient. an. aud.	8	-.71								.81
Orient. an. vis. and aud.	9	-.72								.92
Alertness	10	-.61								.78
Gen. Ton.	11					.74				.66
Motor. mat.	12	-.41				.47		-.44		.83
Pull sit	13					.50	.45			.67
Cuddle	14	-.47				.40			.51	.80
Def. mov.	15	-.77								.80
Consol	16		-.84							.77
Peak excitement	17		.83							.84
Rapid bldup	18		.84							.80
Irrit.	19		.76							.86
Activ.	20					.75				.82
Tremul.	21							.52		.57
Startle	22				.80					.70
Lab. skin color	23						.77			.74
Lab. state	24		.63				.41			.73
Self-quiet	25	-.60							.56	.80
Hand-mouth	26							.79		.79
Smiles	27								.79	.76

APPENDIX F

TABLE 8

DAY TWENTY EIGHT

STEMS	ITEMS	FACTORS I	II	III	IV	V	VI	VII	h^2
Habit. light	1			-.80					.77
Habit. rattle	2			-.94					.91
Habit. bell	3			-.94					.91
Pinprick	4					.70			.77
Orient. inan. vis.	5	-.81							.68
Orient. inan. aud.	6	-.68							.67
Orient. an. vis.	7	-.82							.85
Orient. an. aud.	8	-.71							.65
Orient. an. vis. and aud.	9	-.87							.86
Alertness	10	-.77							.83
Gen. Ton.	11				.43			.49	.65
Motor Mat.	12							.58	.67
Pull sit	13							.78	.68
Cuddle	14					-.64			.64
Def. mov.	15	-.44						.70	.73
Consol	16		-.82						.80
Peak excite	17		.67					.41	.82
Rapid bldup	18		.85						.75
Irrit.	19		.50		.52				.63
Activ.	20							.60	.70
Tremul.	21						.80		.75
Startle	22					-.52			.41
Lab. skin color	23		.63						.67
Lab. state	24		.85						.80
Self-quiet	25				.49	-.40			.57
Hand-mouth	26				.75				.72
Smiles	27				-.69				.69

APPENDIX G

APPENDIX G

TABLE 1

DRUG CODE

1. Local and Regional Anesthetics (Classified according to route of administration):

    1.0 unknown or others (i.e., not listed)
    1.1 perineal (local)
    1.2 pudendal or paracervical block)
    1.3 spinal, saddle block, caudal, epidural) — regional

2. Tranquilizers

    2.0 unknown and not listed
    2.1 Chlorpromazine (Thorazine), Base dose: 50 mg
    2.2 Diazepam (Valium), Base dose: 5 mg
    2.3 Chlordiazepoxide (Librium), Base dose: 10 mg
    2.4 Hydroxizine (Atarax), Base dose: 25 mg
    2.5 Promethazine (Phenergan), Base dose: 25 mg

3. Narcotic Analgesics

    3.0 not listed or unknown
    3.1 Meperidine (Demerol), Base dose: 50 mg
    3.2 Alphaprodine (Nisentil), Base dose: 30 mg
    3.3 Fentanyl citrate, Base dose: 0.1 mg (given only in combination with Droperidol (Innovar), Base dose: 5 mg
    3.4 Morphine, Base dose: 10 mg

4. Barbiturates

    4.0 other or unknown
    4.1 Thiopental (Na Penthotal), I.V. (dose not usually recorded)
    4.2 Secobarbital (Seconal), P.O., Base does: gr. 1/2 (or rectal)

5. Inhalation General Anesthetics

    5.0 other and unknown
    5.1 Nitrous oxide
    5.2 Cyclopropane
    5.3 Methoxyflurane (penthrane)
    5.4 Fluothane

6. Scopolamine (hyoscine), Base dose: 1/2 amp.

7. Muscle Relaxant Succinil choline(Anectine)

Appendix G

Table 2

Intercorrelation Between Drug Grouped According to Type

(Using Pearson r.)

Significant Correlations

	Σ 1	Σ 2	Σ 3	Σ 4	Σ 5	Σ 6	7	Σ All
Σ 1								
Σ 2	.23							
Σ 3	-.18	-.10						
Σ 4	-.20	-.10	.34*					
Σ 5	-.56**	-.22	.37*	.27				
6	-.54**	-.50**	.33*	.31*	.53**			
7	-.40**	-.04	-.01	.17	.33*	-.05		
Σ All	-.29	.04	.71**	.80**	.60**	.47**	.18	

Σ1 = all local anesthesia

Σ2 = all tranquilizers

Σ3 = all narcotics

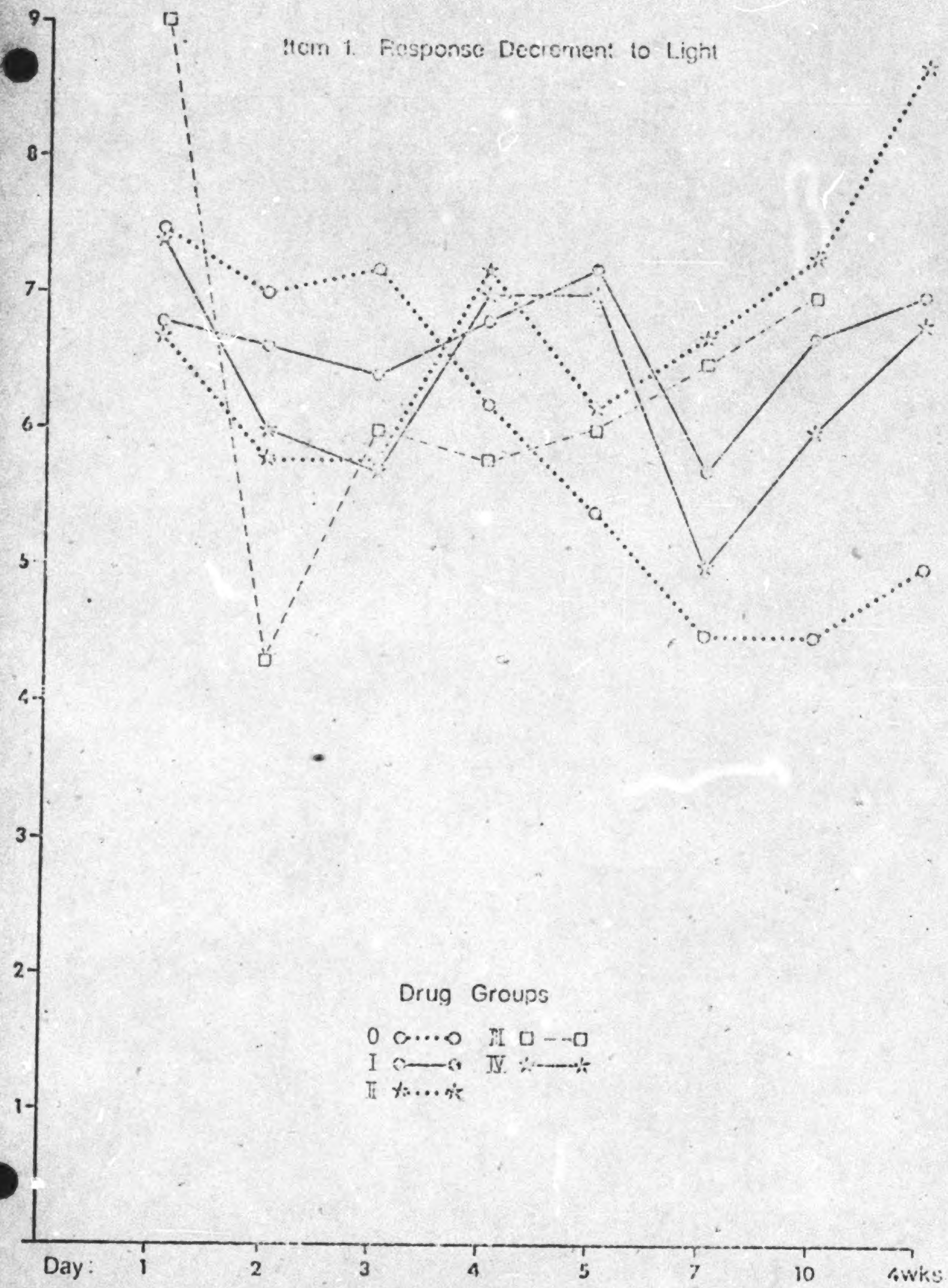
Σ4 = all barbiturates

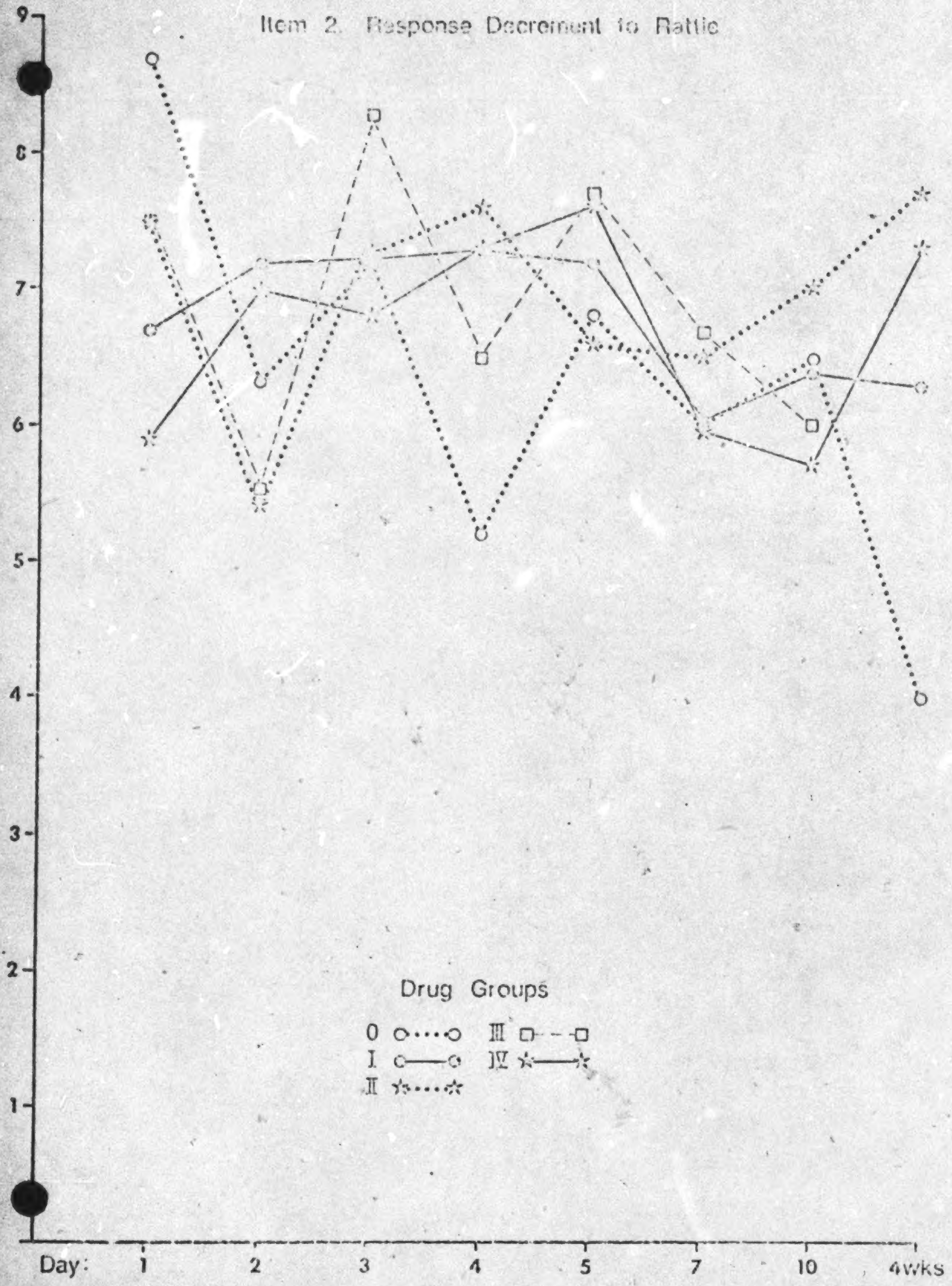
Σ5 = all general anesthetics

6 = Scopolamine

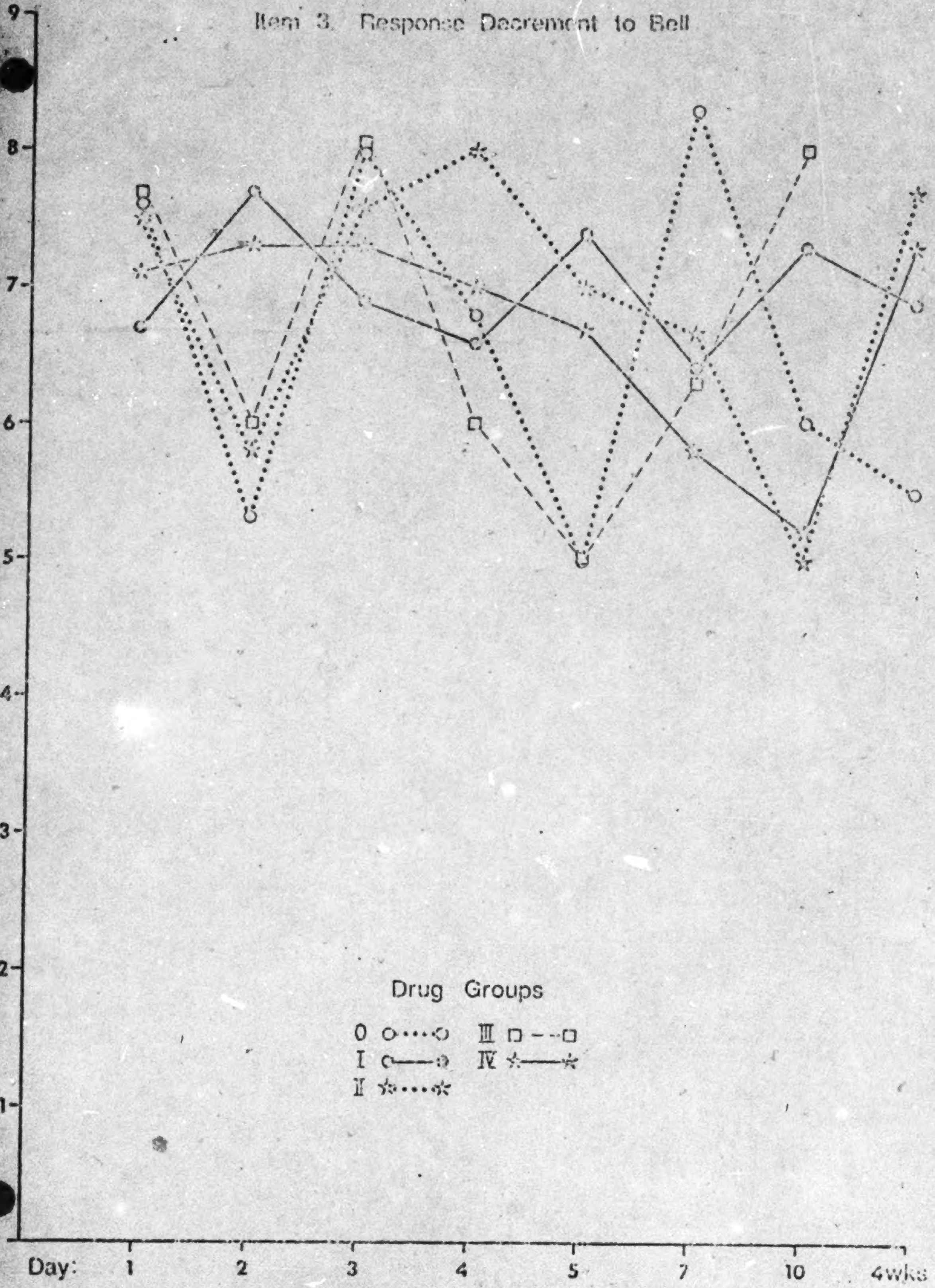
7 = muscle relaxant

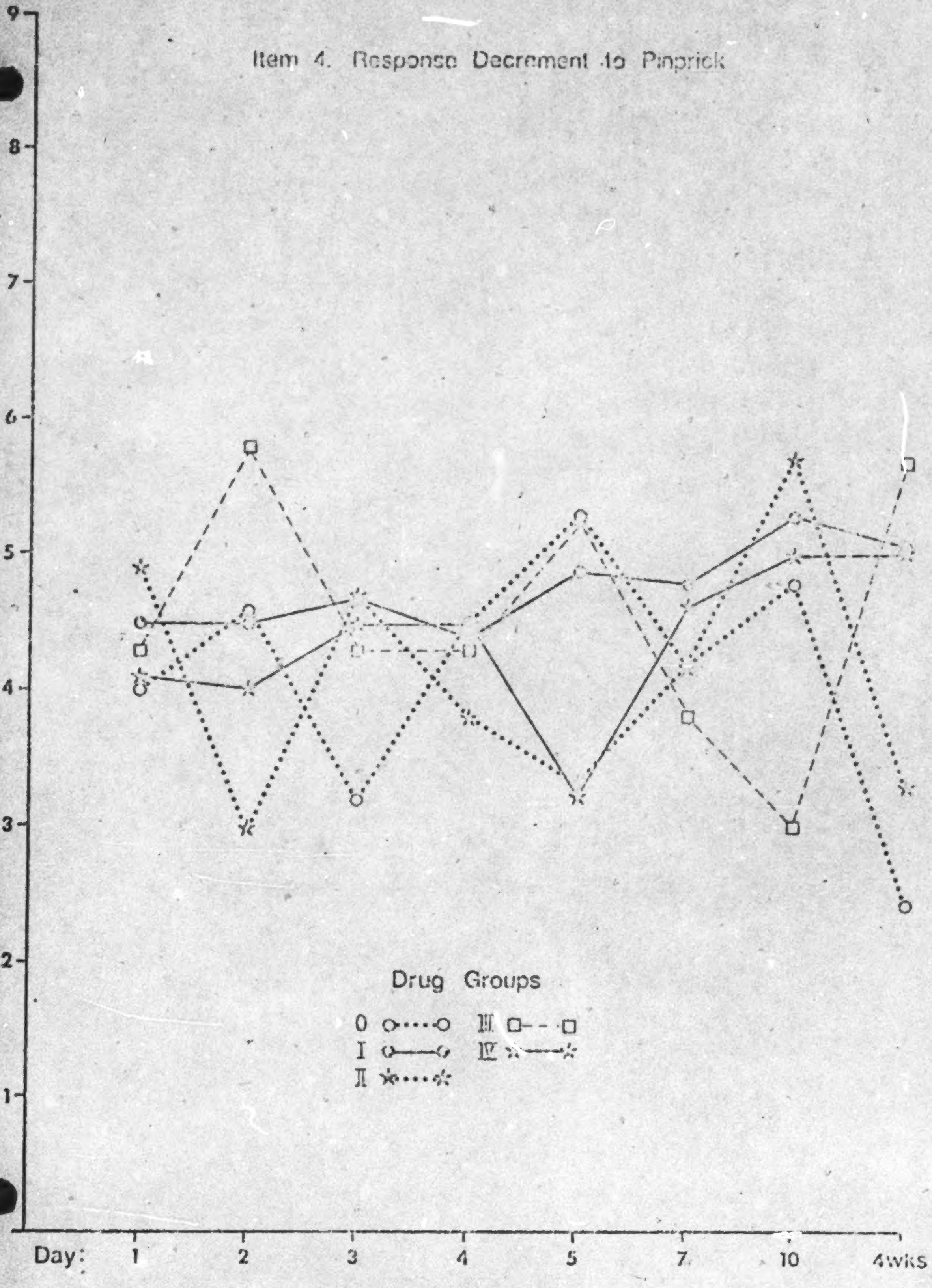
APPENDIX H


Item 1. Response Decrement to Light
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 ○····○
I ○——○
II ☆····☆
III □--□
IV ☆——☆

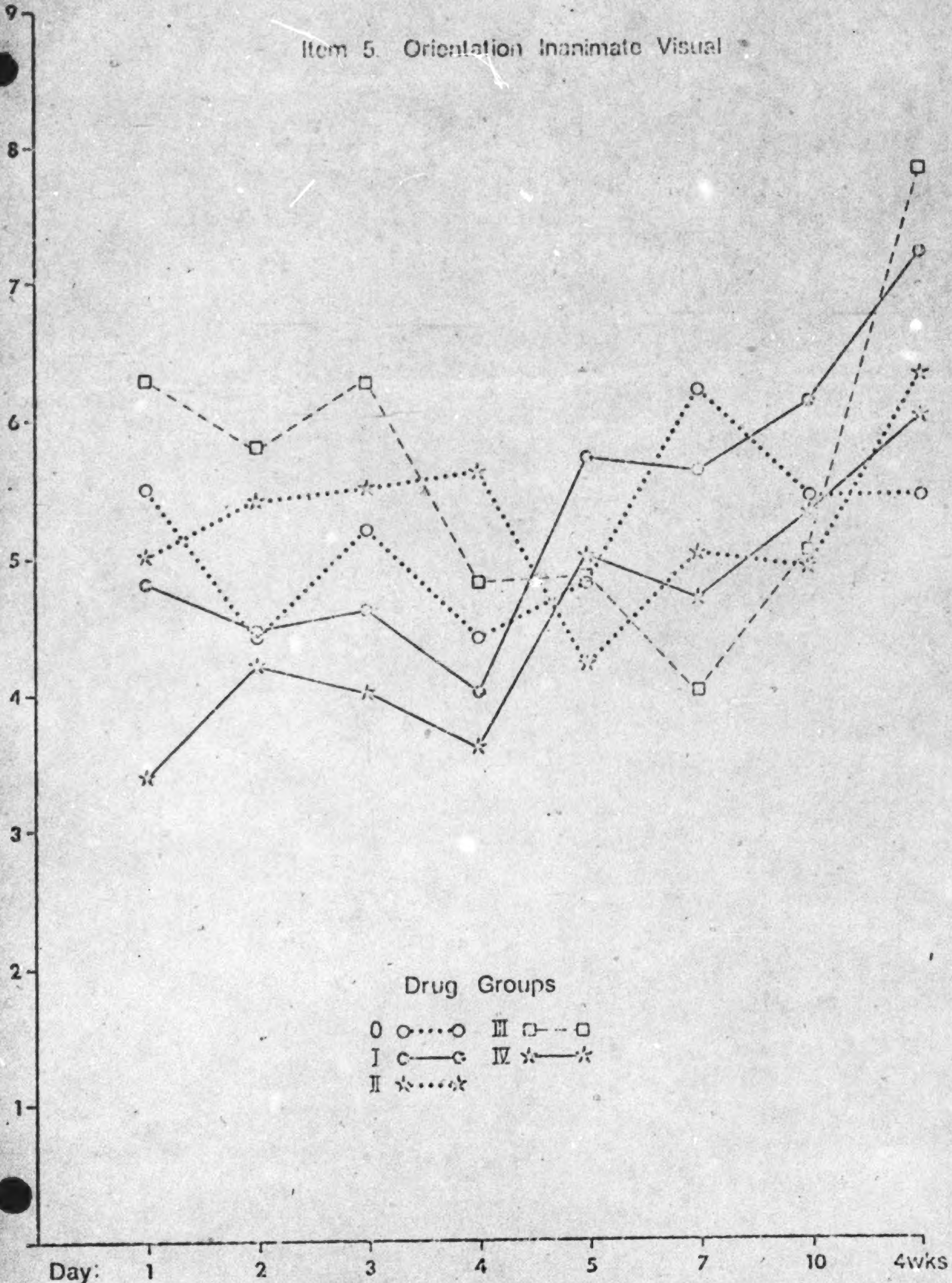


Item 2. Response Decrement to Rattle

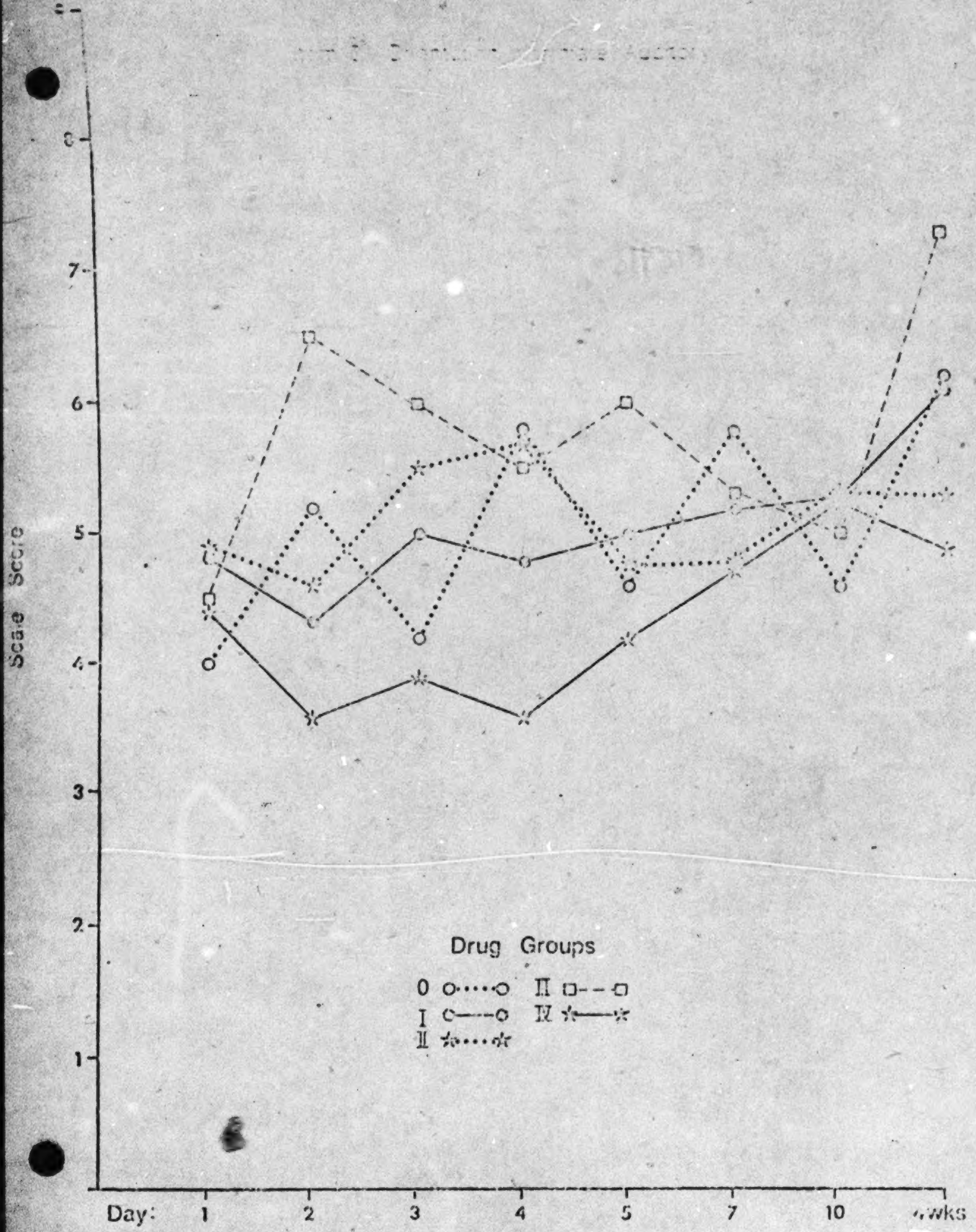

Item 3. Response Decrement to Bell

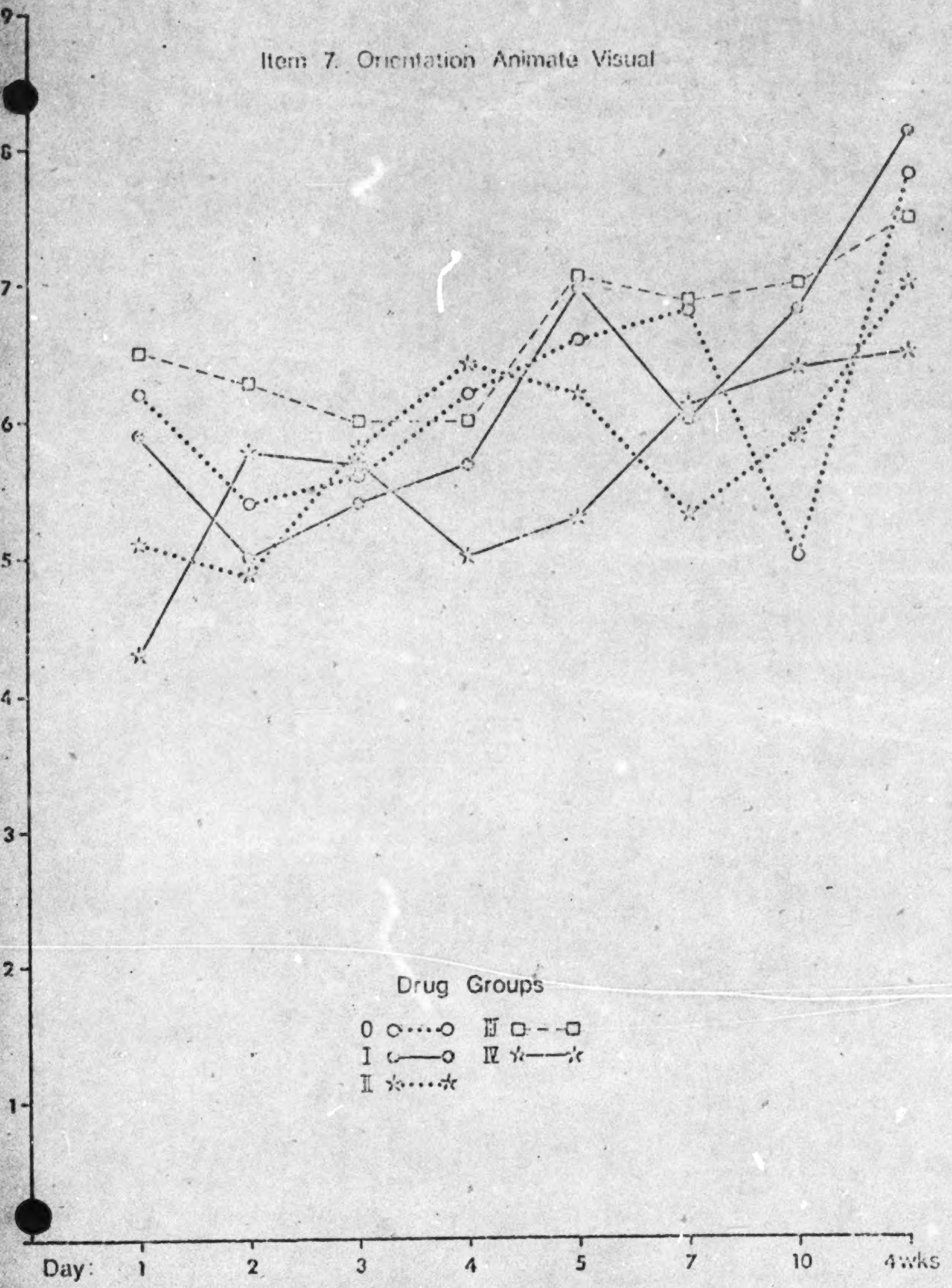


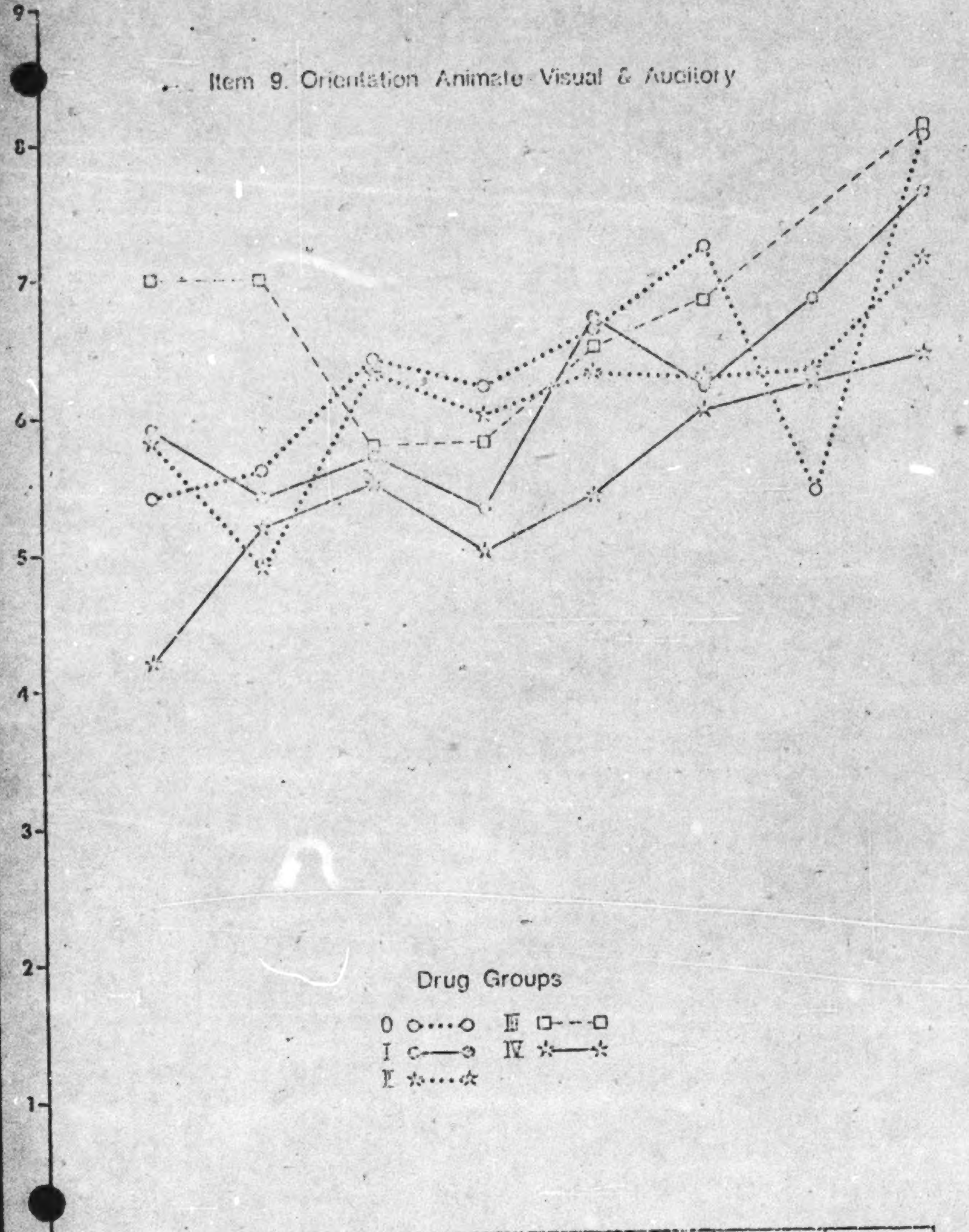
Item 4. Response Decrement to Pinprick



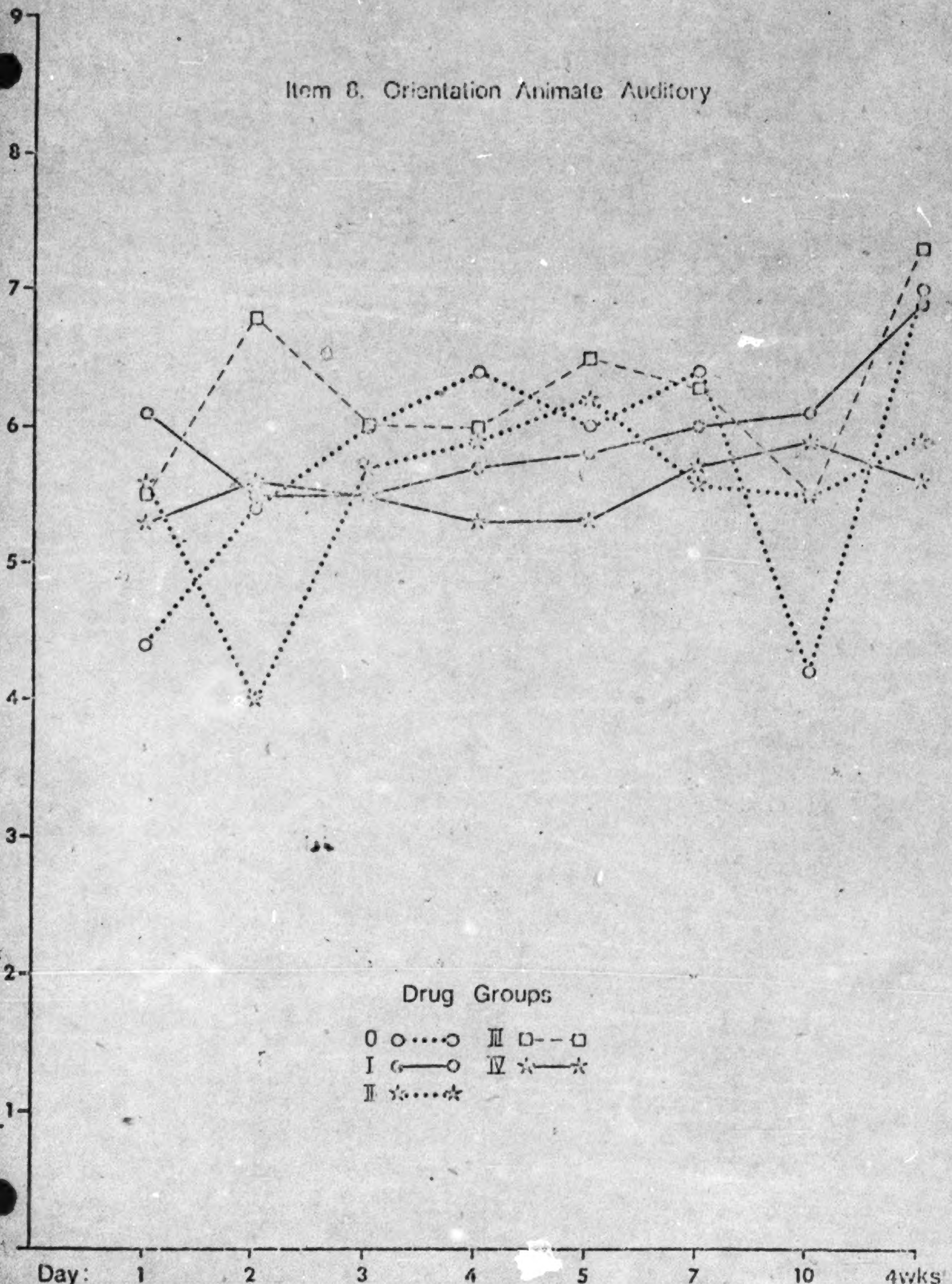
Item 5. Orientation Inanimate Visual

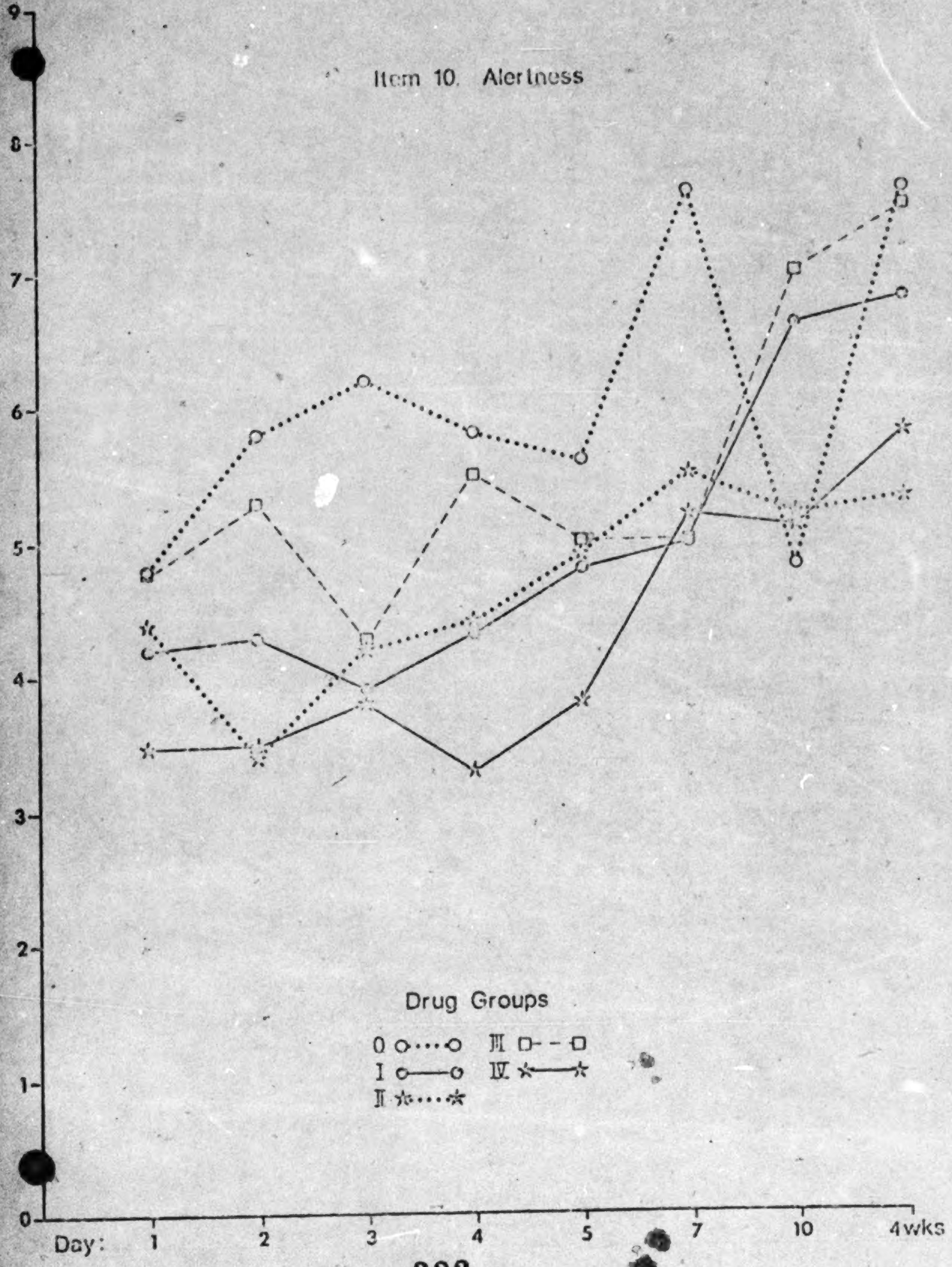

Scale Score
8
7
6
5
4
3
2
1
Day: 1 2 3 4 5 7 10 4wks
Drug Groups
0 ○·····○
I ○——○
II ☆·····☆
III □- - □
IV ☆——☆


Item 7. Orientation Animate Visual
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4 wks
Drug Groups
0 o····o
I o——o
II ☆····☆
III □- - -□
IV ☆——☆

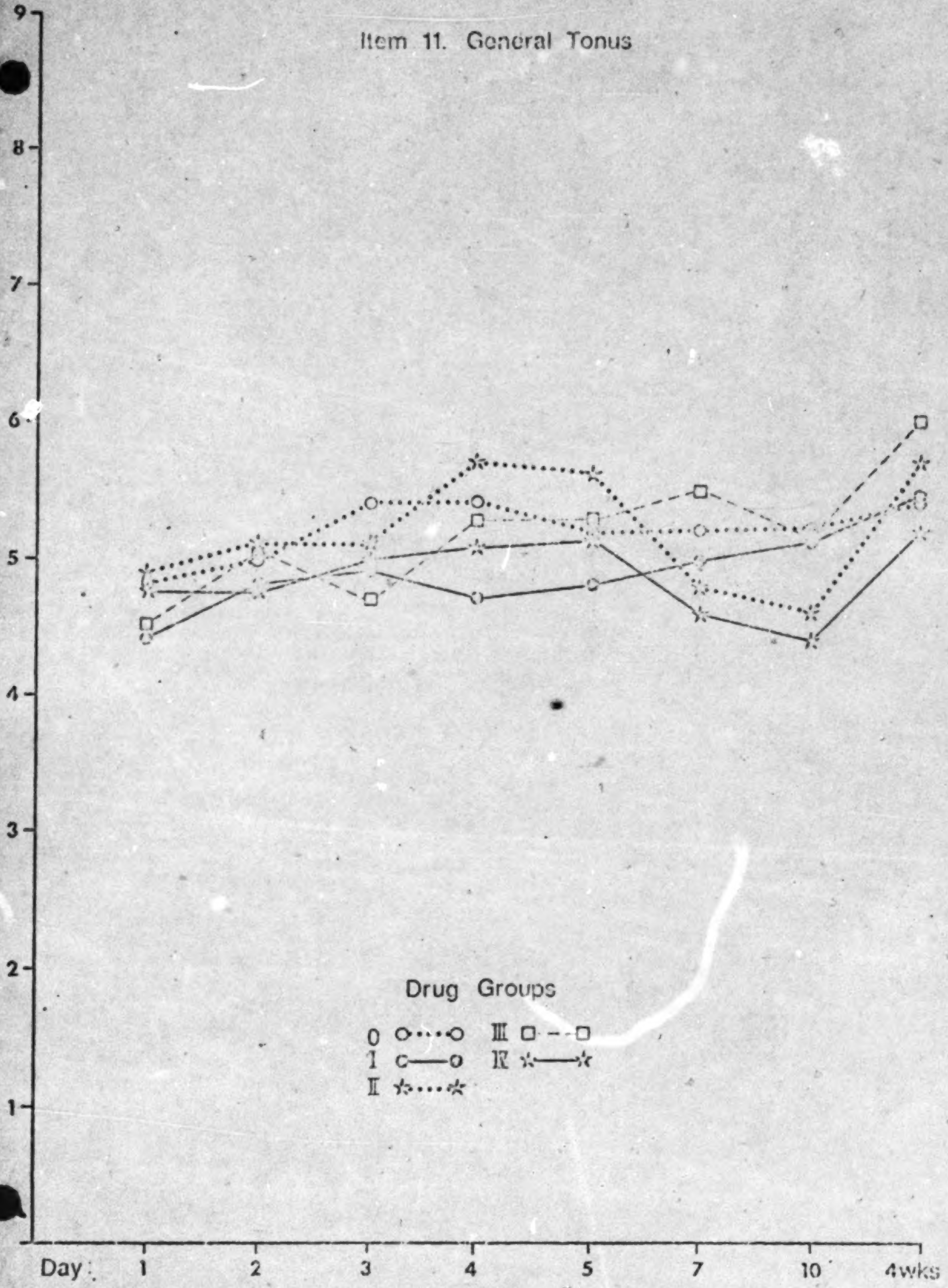


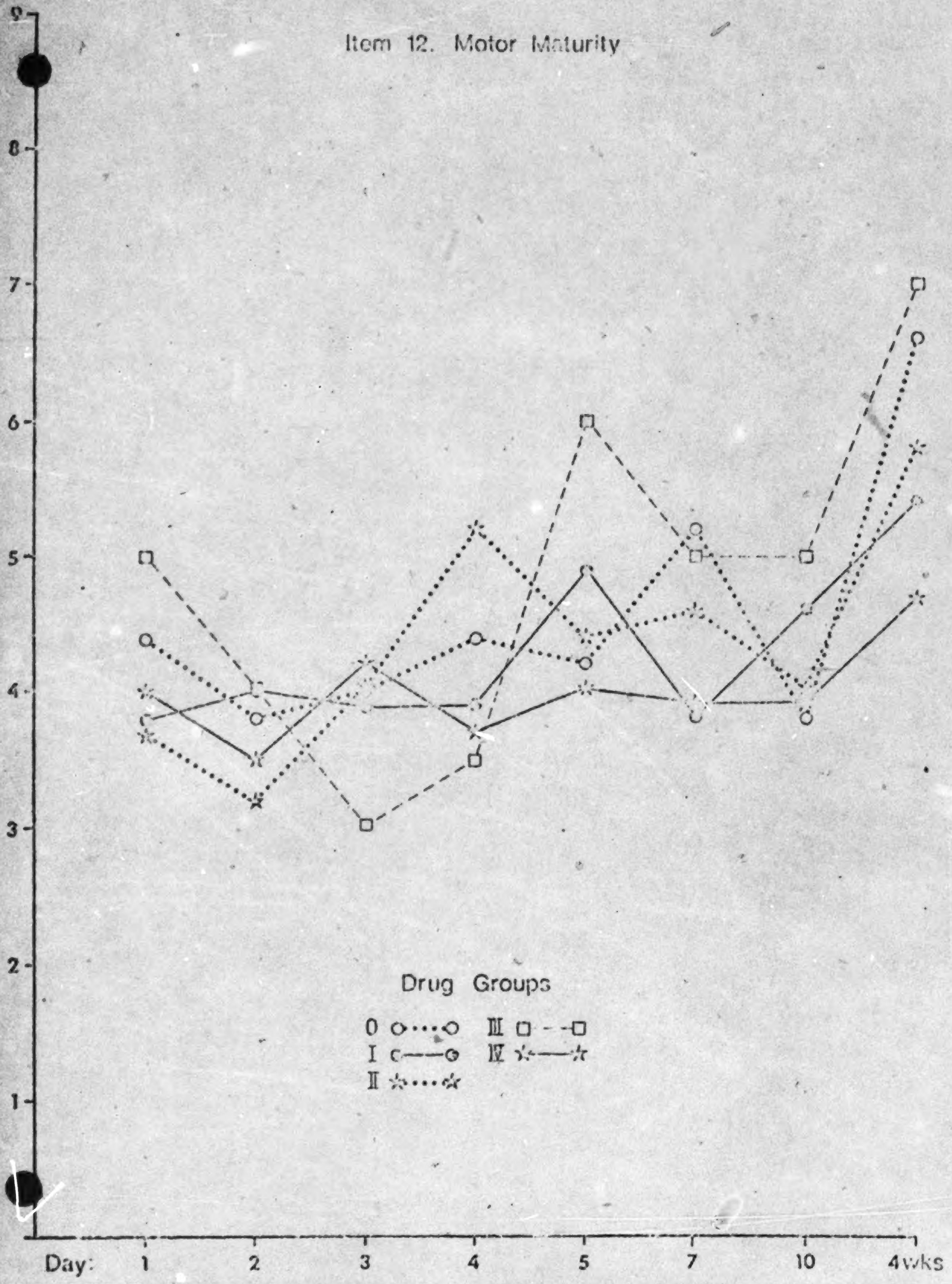
Item 9. Orientation Animate Visual & Auditory

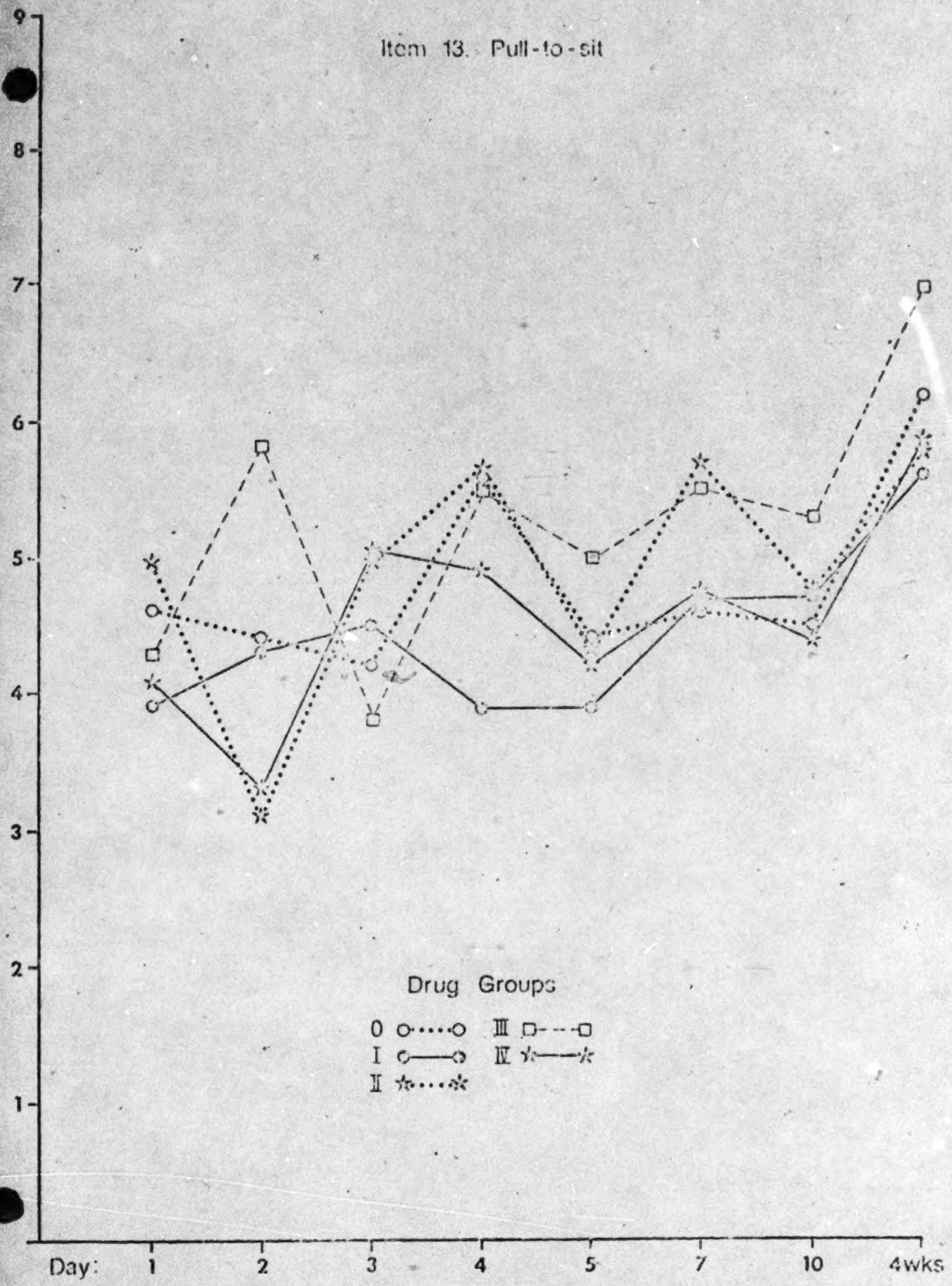

Item 8. Orientation Animate Auditory
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 o····o
I o——o
II ☆····☆
III □– –□
IV ☆——☆

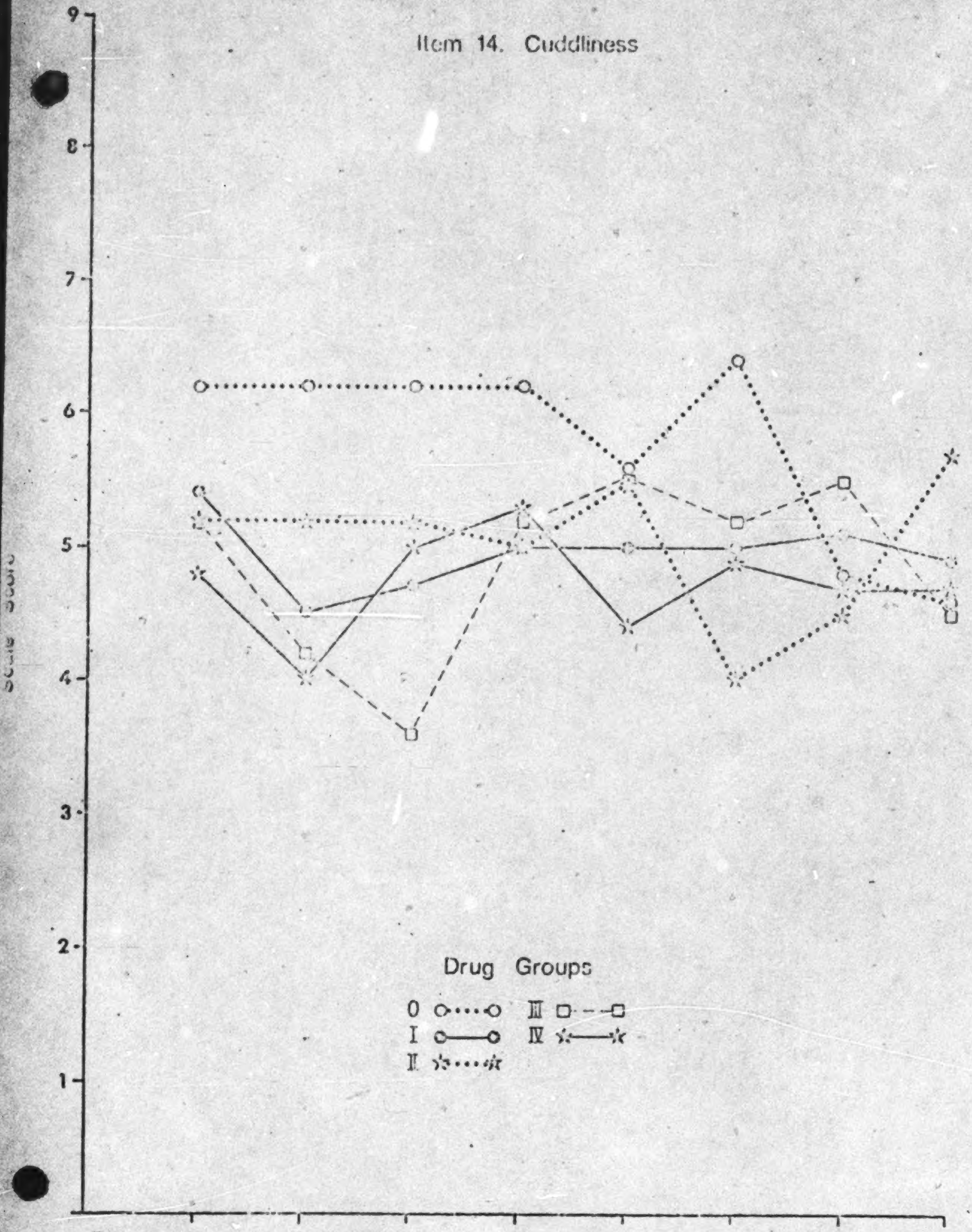


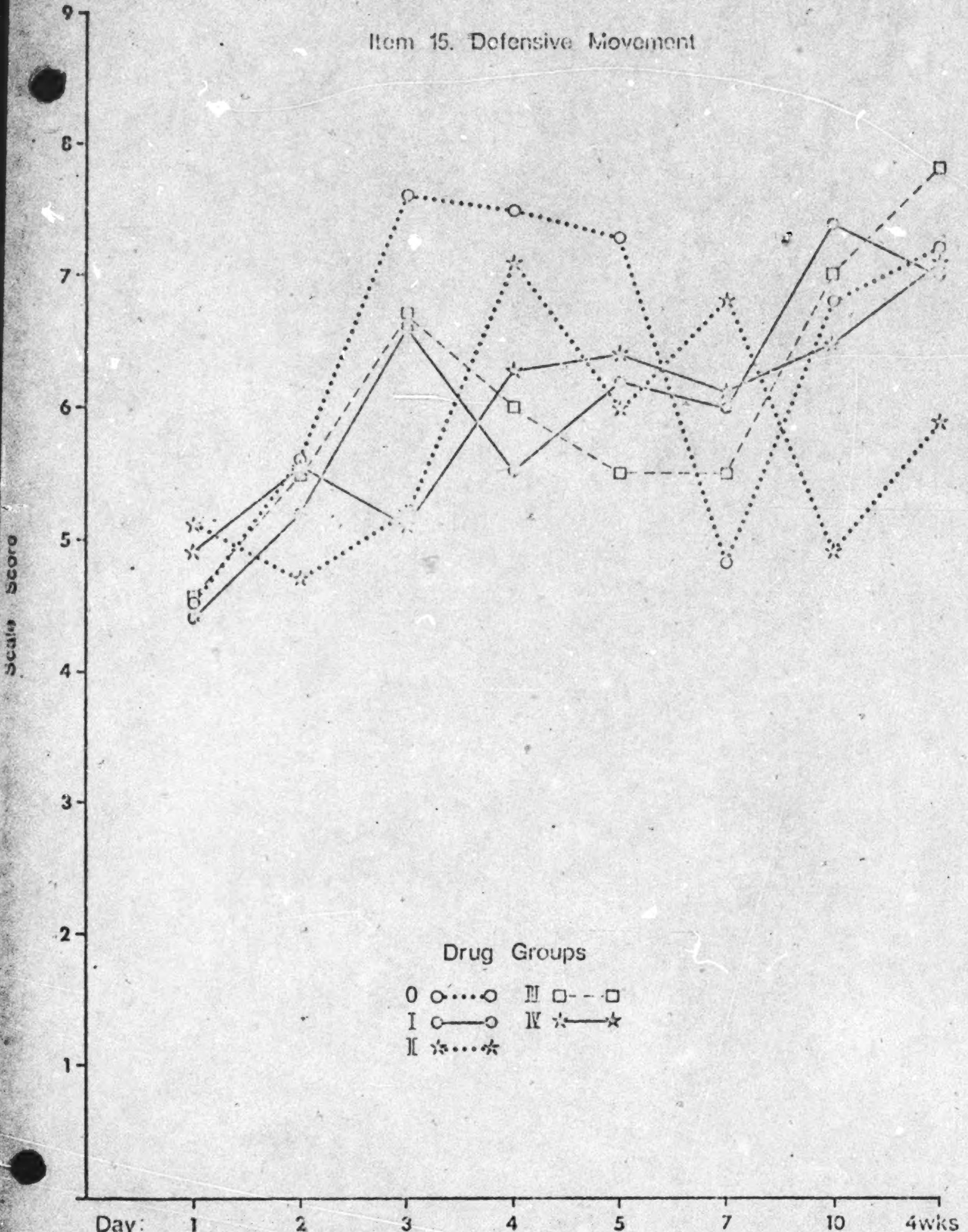
Item 10. Alertness
9
8
7
6
5
4
3
2
1
0
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 o····o
I o——o
II ☆····☆
III □- - □
IV ☆——☆

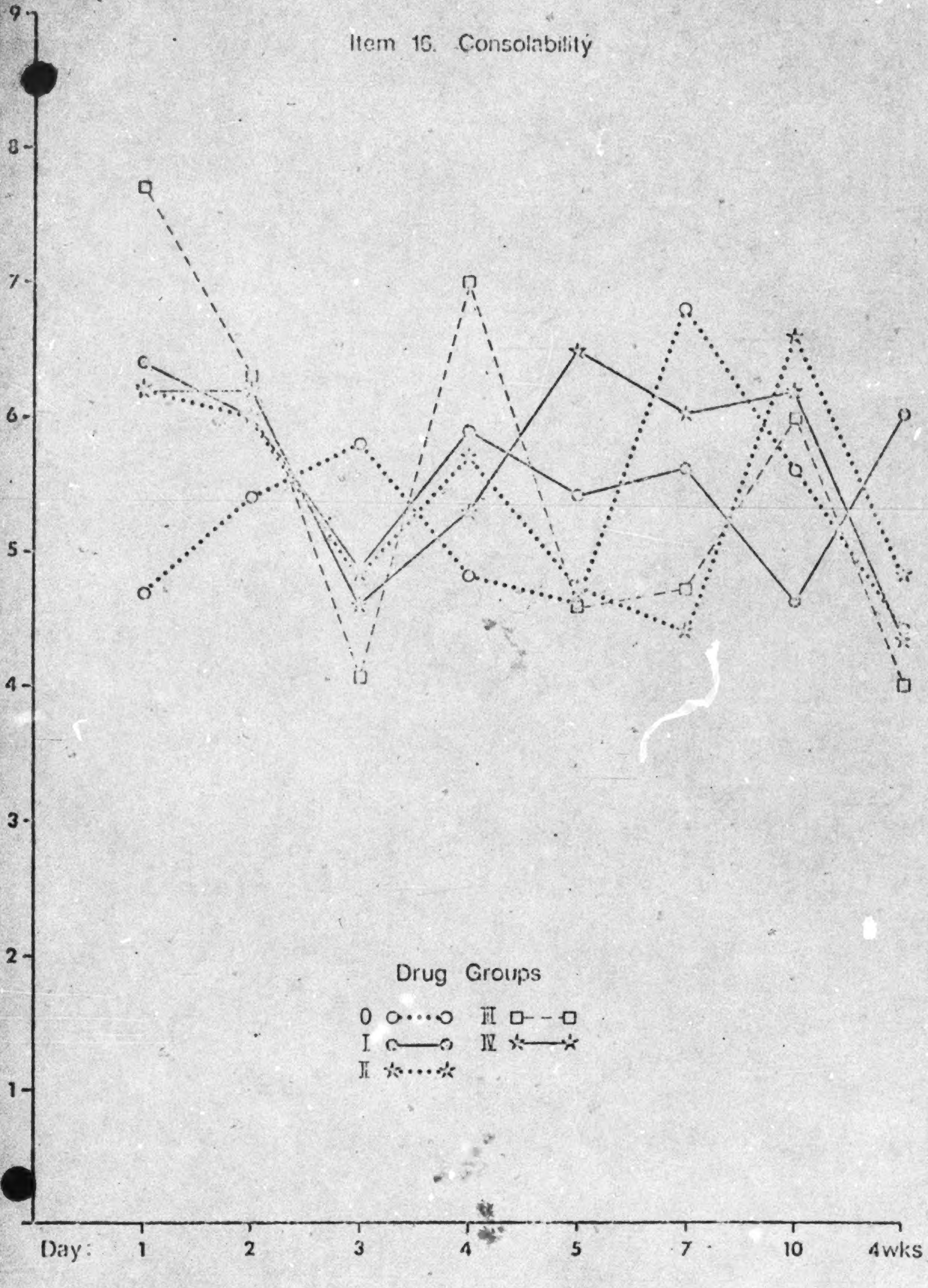

Item 11. General Tonus
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 ○····○
I ○——○
II ☆····☆
III □- -□
IV ☆——☆

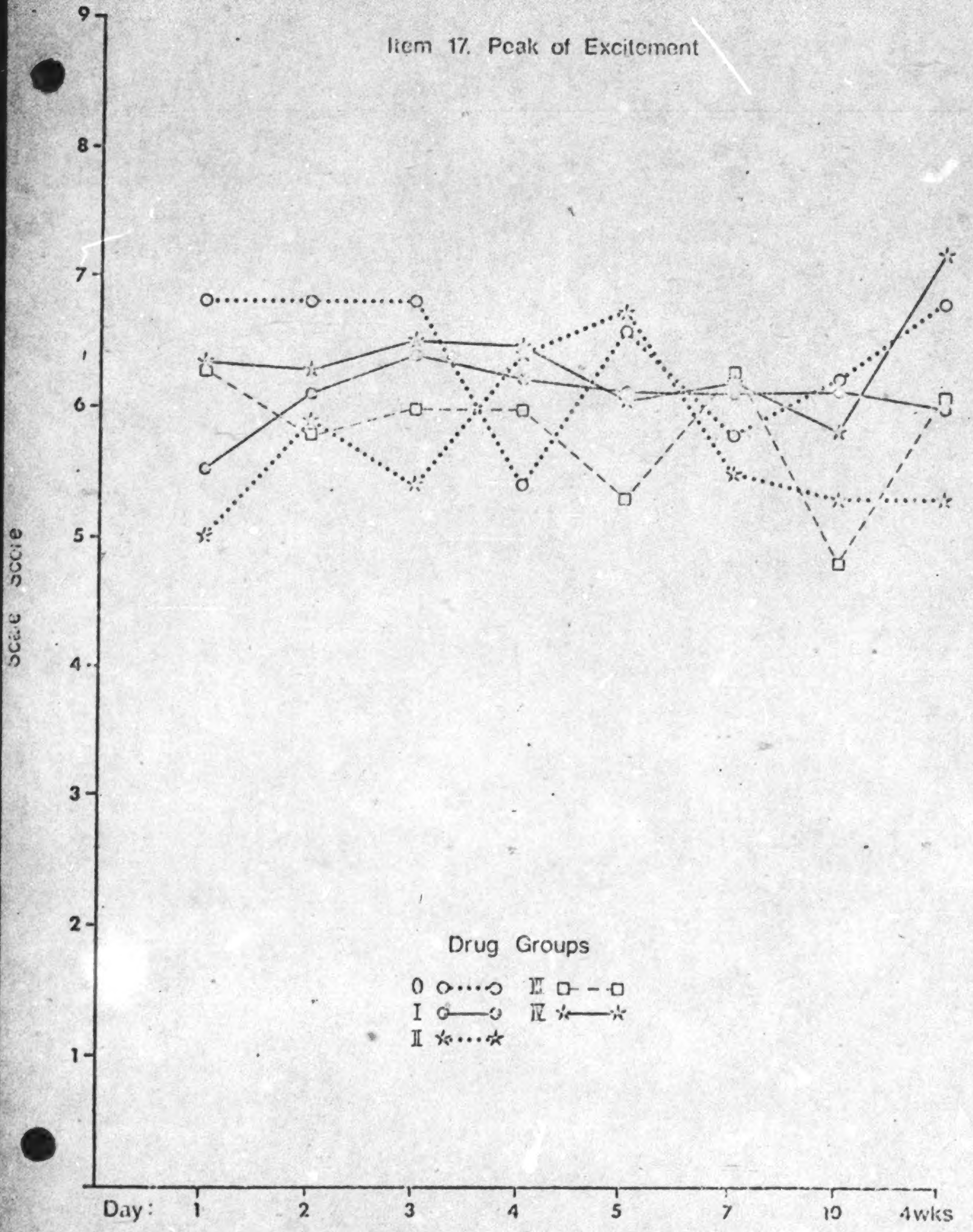

Item 12. Motor Maturity

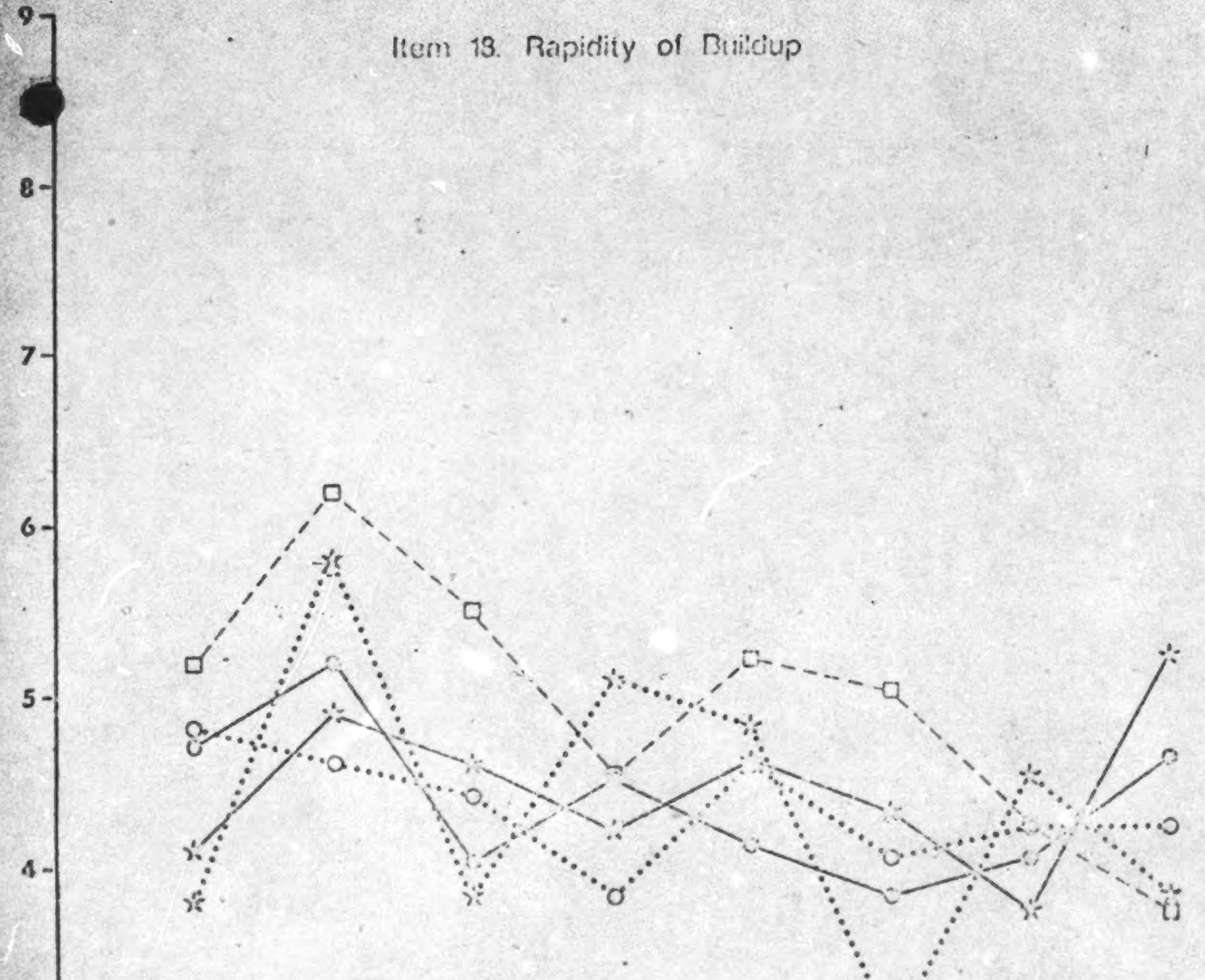

Item 13. Pull-to-sit
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 o·····o
I o——o
II ☆·····☆
III □- - -□
IV ☆——☆


Item 14. Cuddliness
Scale Score
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 ○····○
I ○—○
II ☆····☆
III □--□
IV ☆—☆

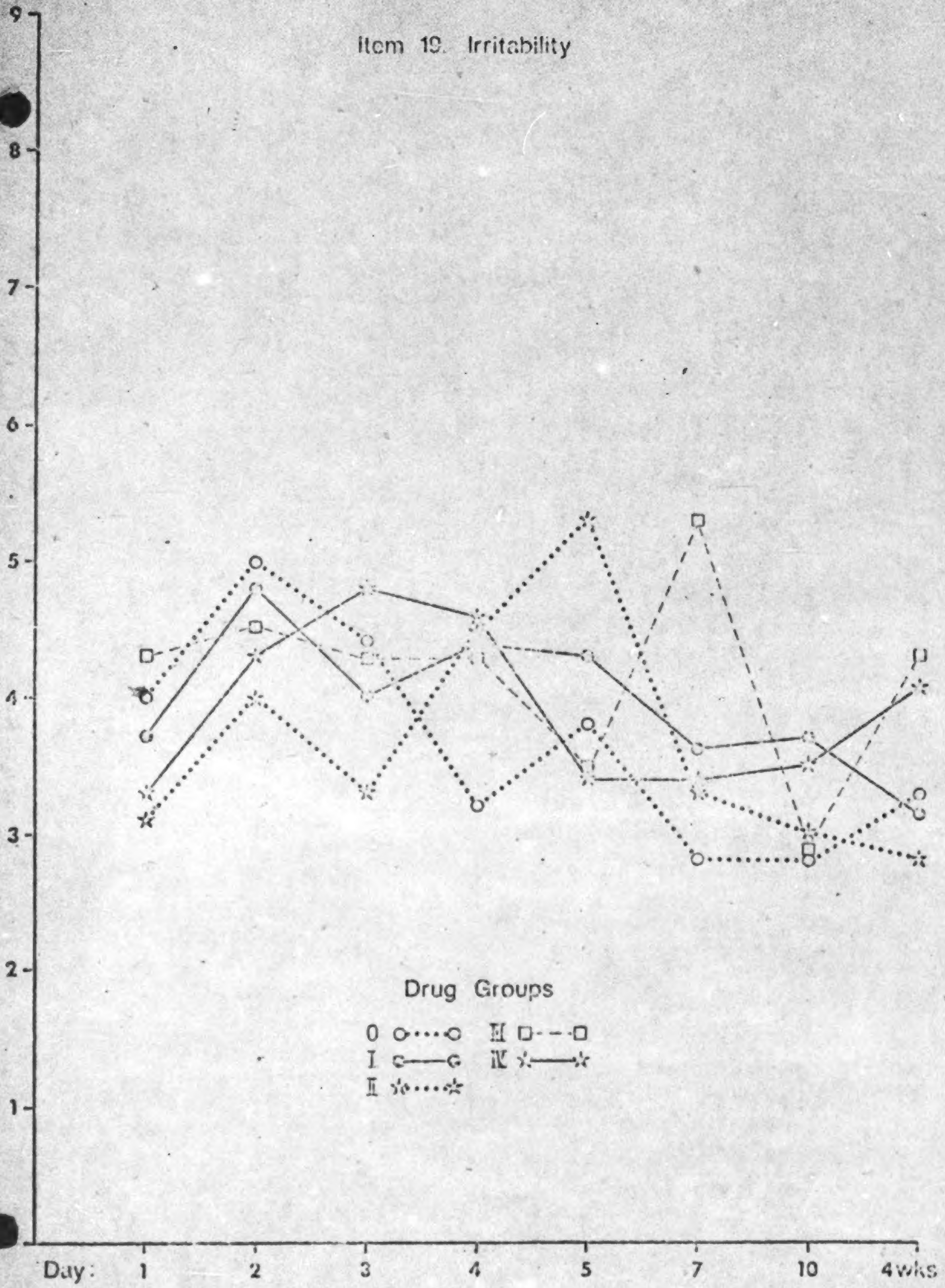

Item 15. Defensive Movement
Scale Score
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 o····o
I o——o
II ☆····☆
III □- - -□
IV ☆——☆

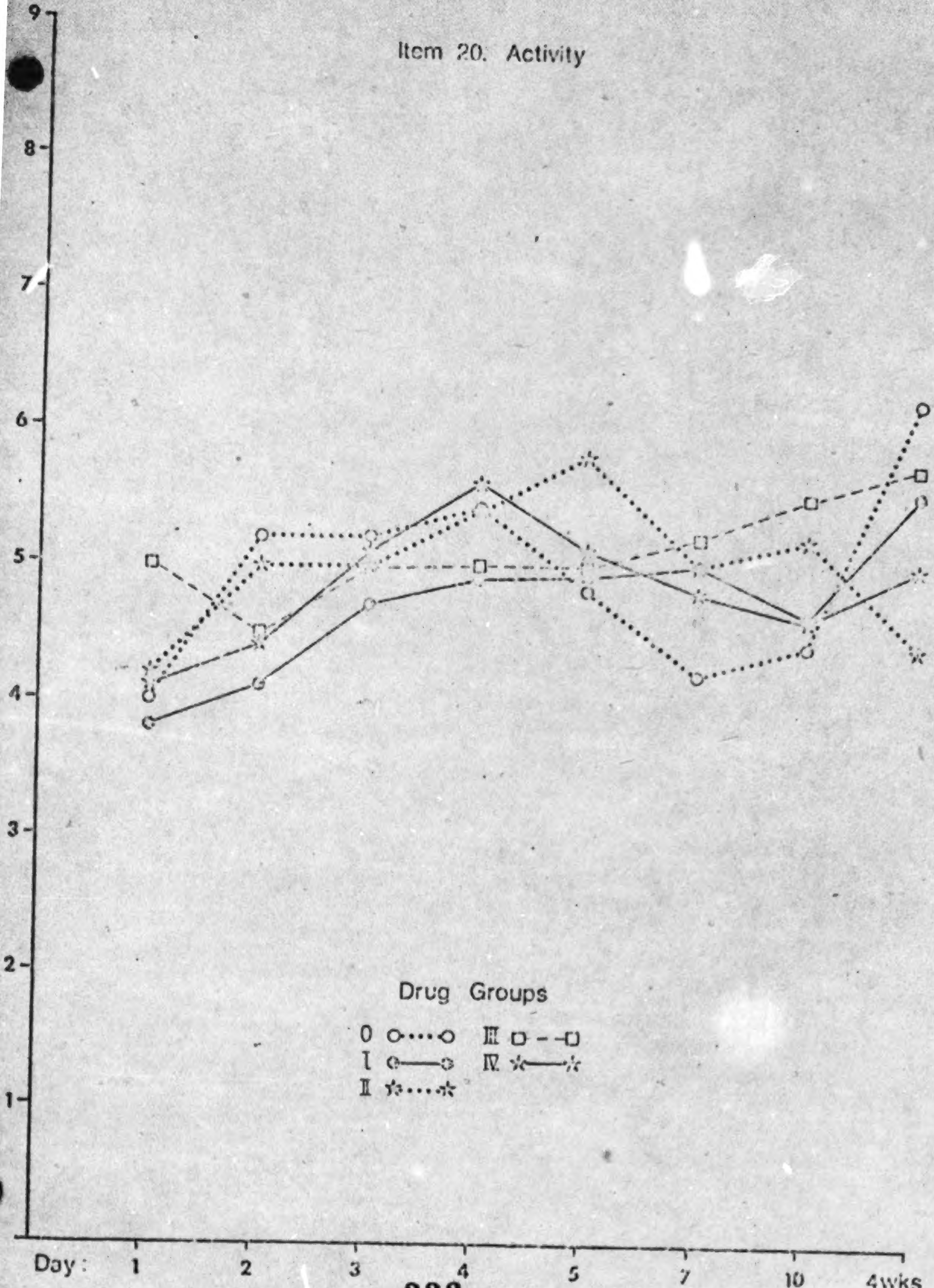

Item 16. Consolability
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 ○····○
I ○—○
II ☆····☆
III □- -□
IV ☆—☆

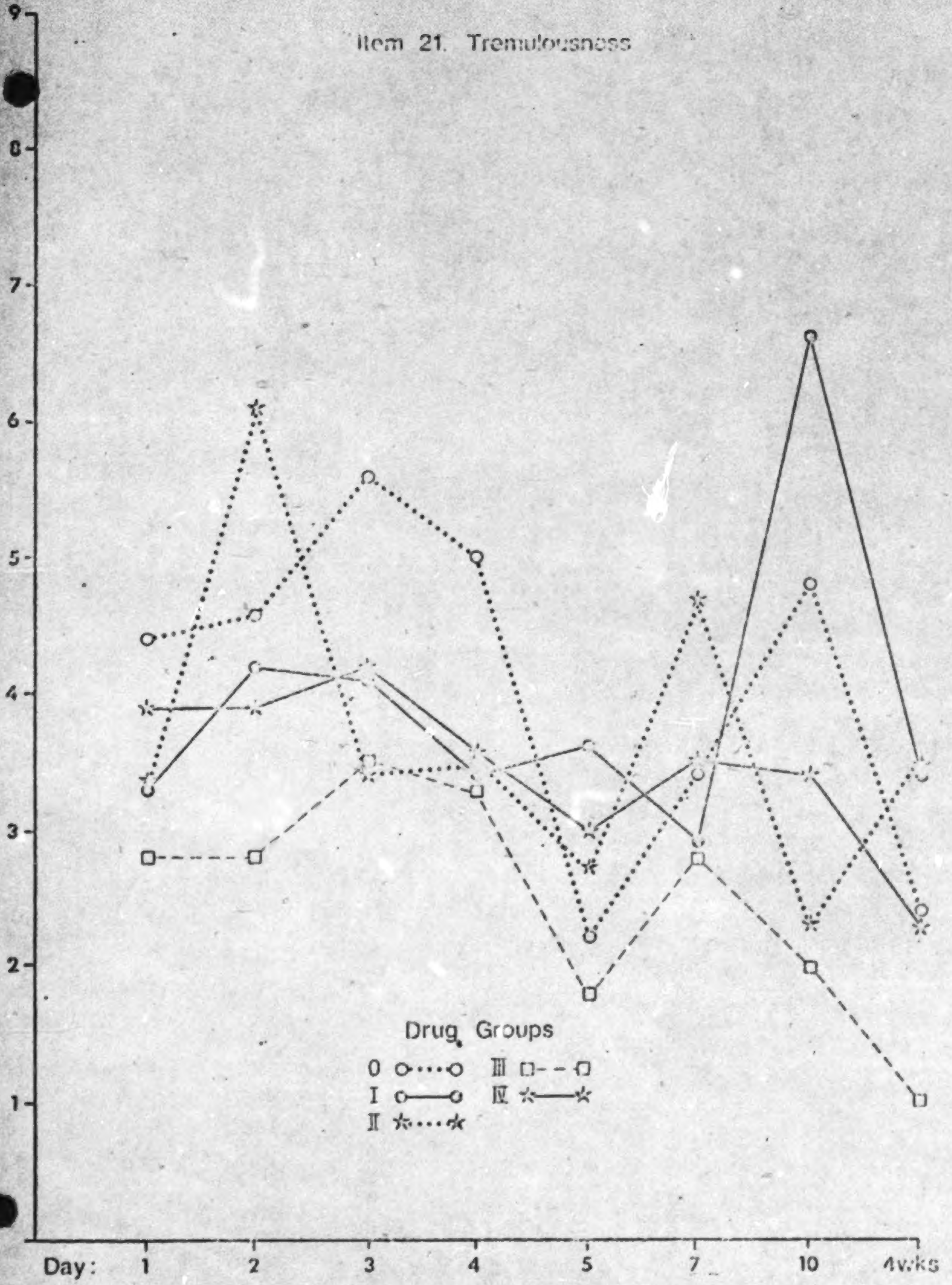

Item 17. Peak of Excitement
Scale Score
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 ○····○
I ○——○
II ☆····☆
III □– –□
IV ☆——☆

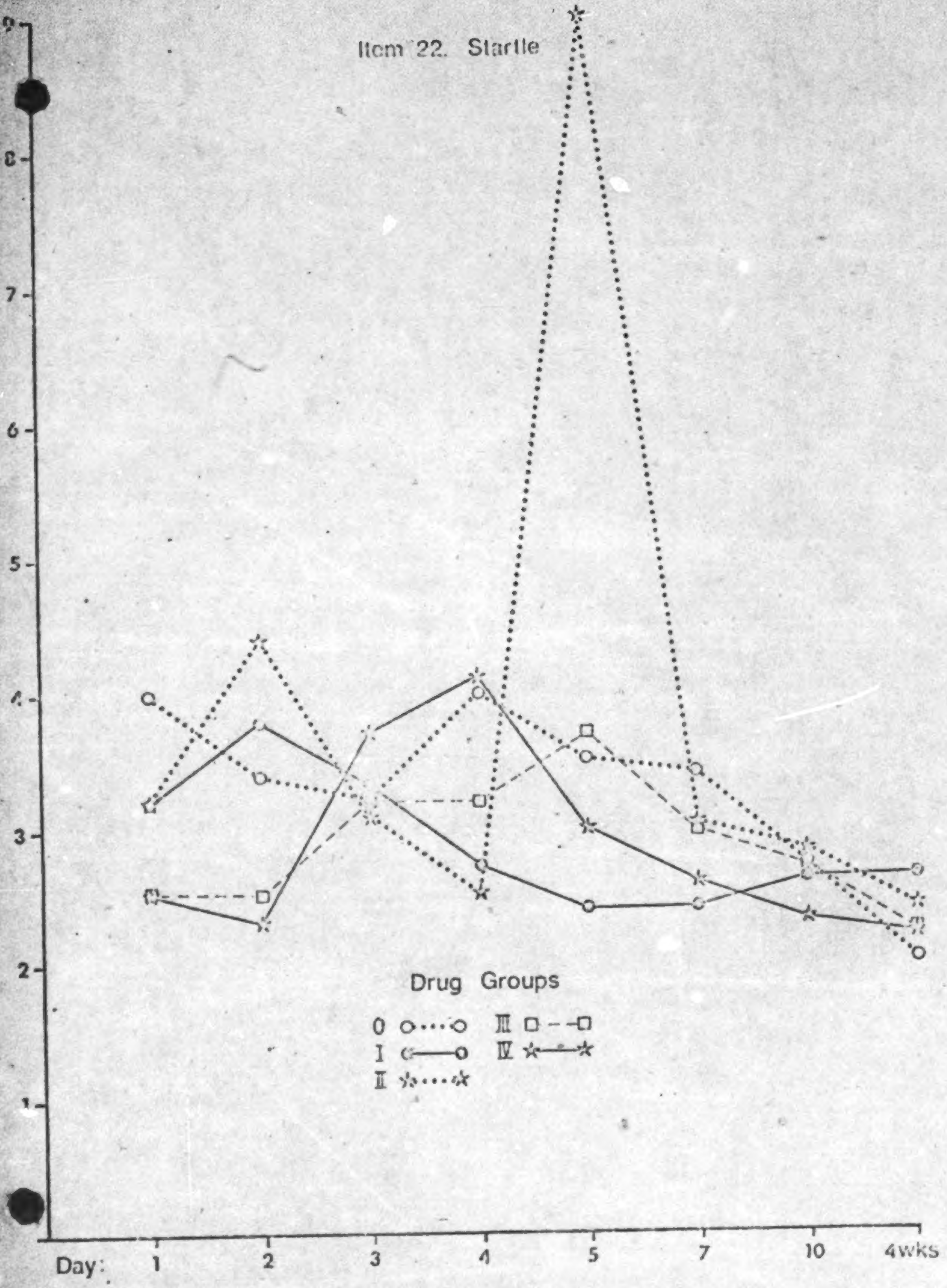


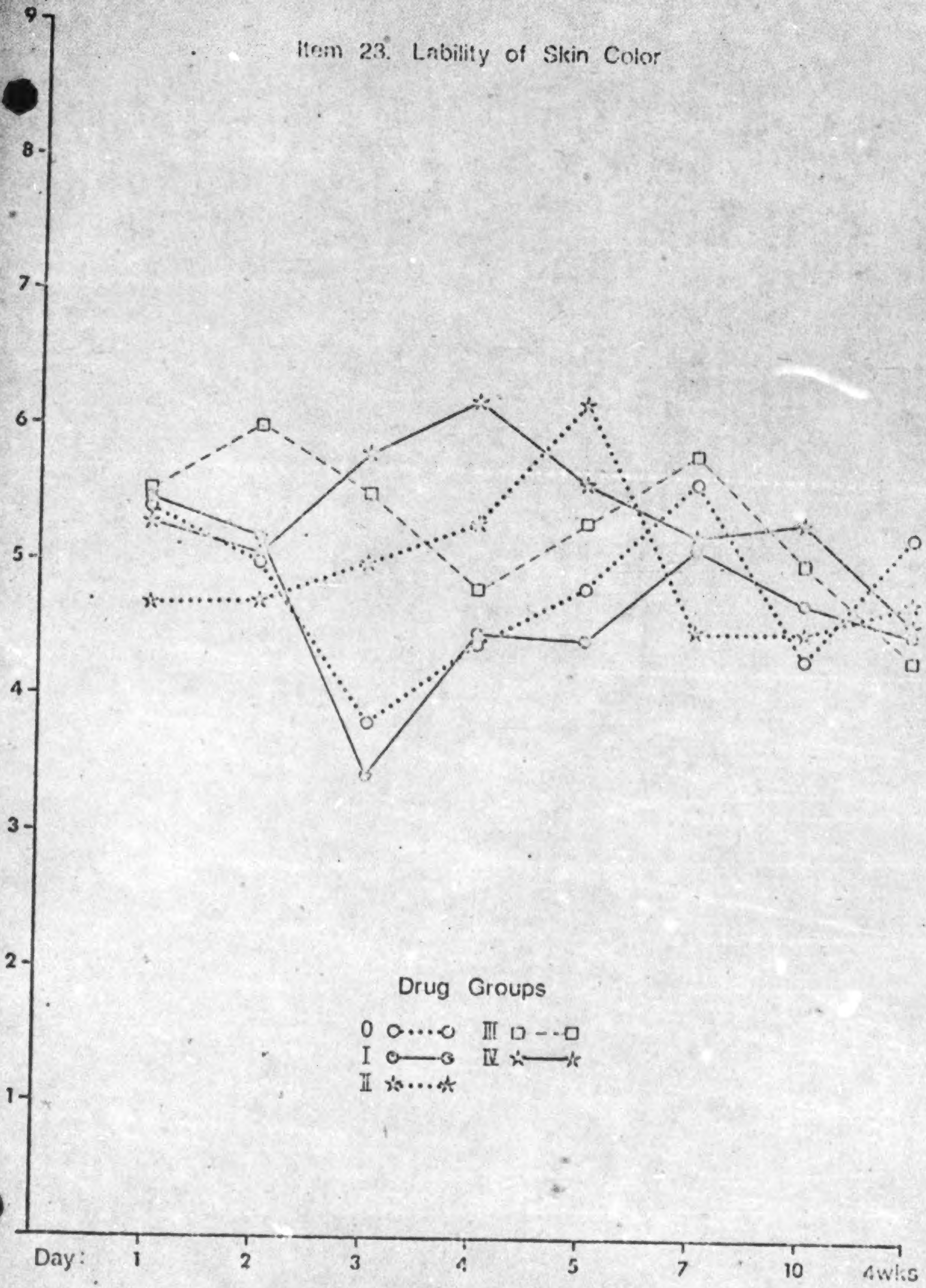
Item 18. Rapidity of Buildup

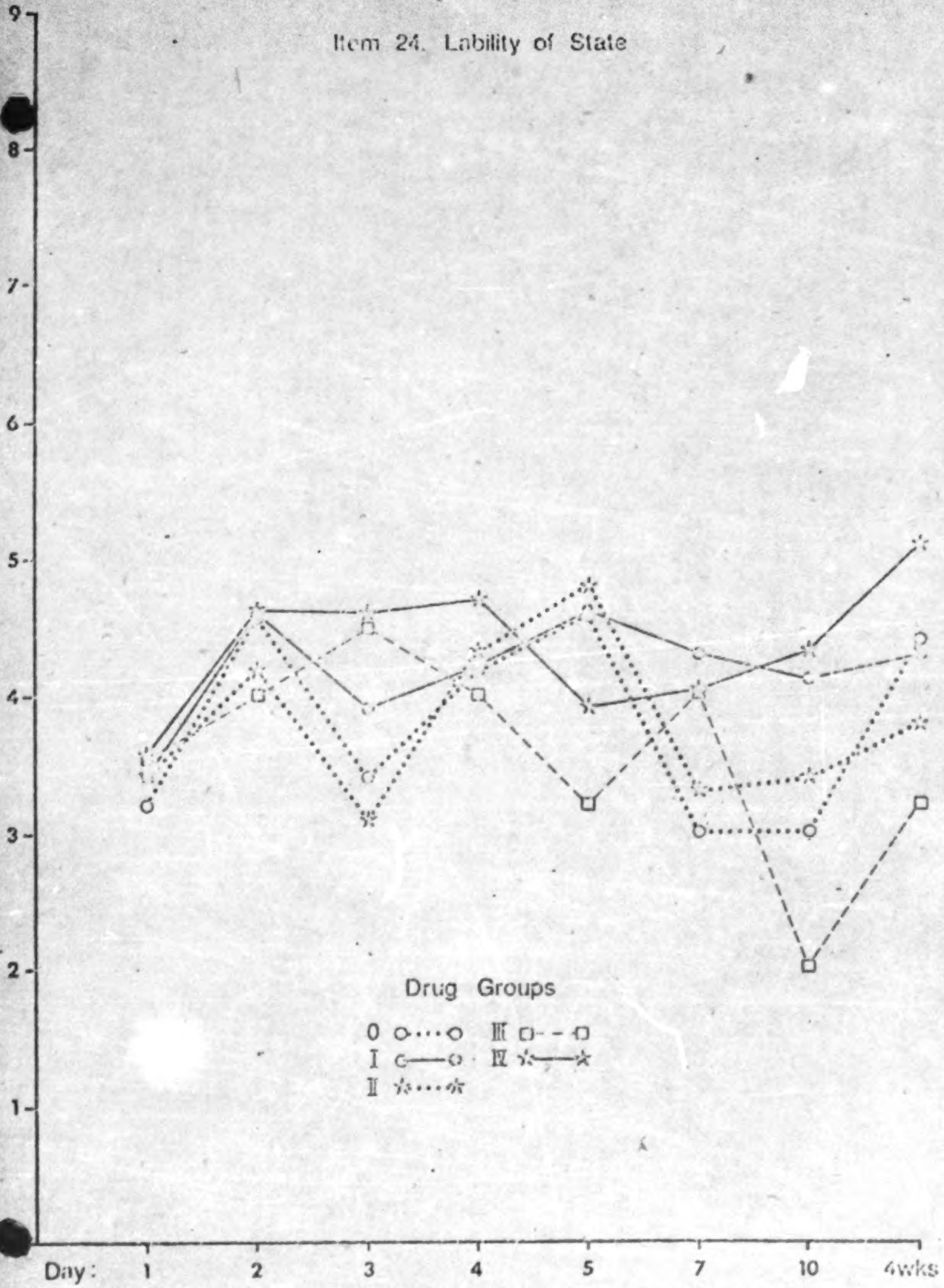

Item 19. Irritability
9
8
7
6
5
4
3
2
1
Day: 1 2 3 4 5 7 10 4wks
Drug Groups
0 o····o
I o——o
II ☆····☆
III □- - -□
IV ☆——☆

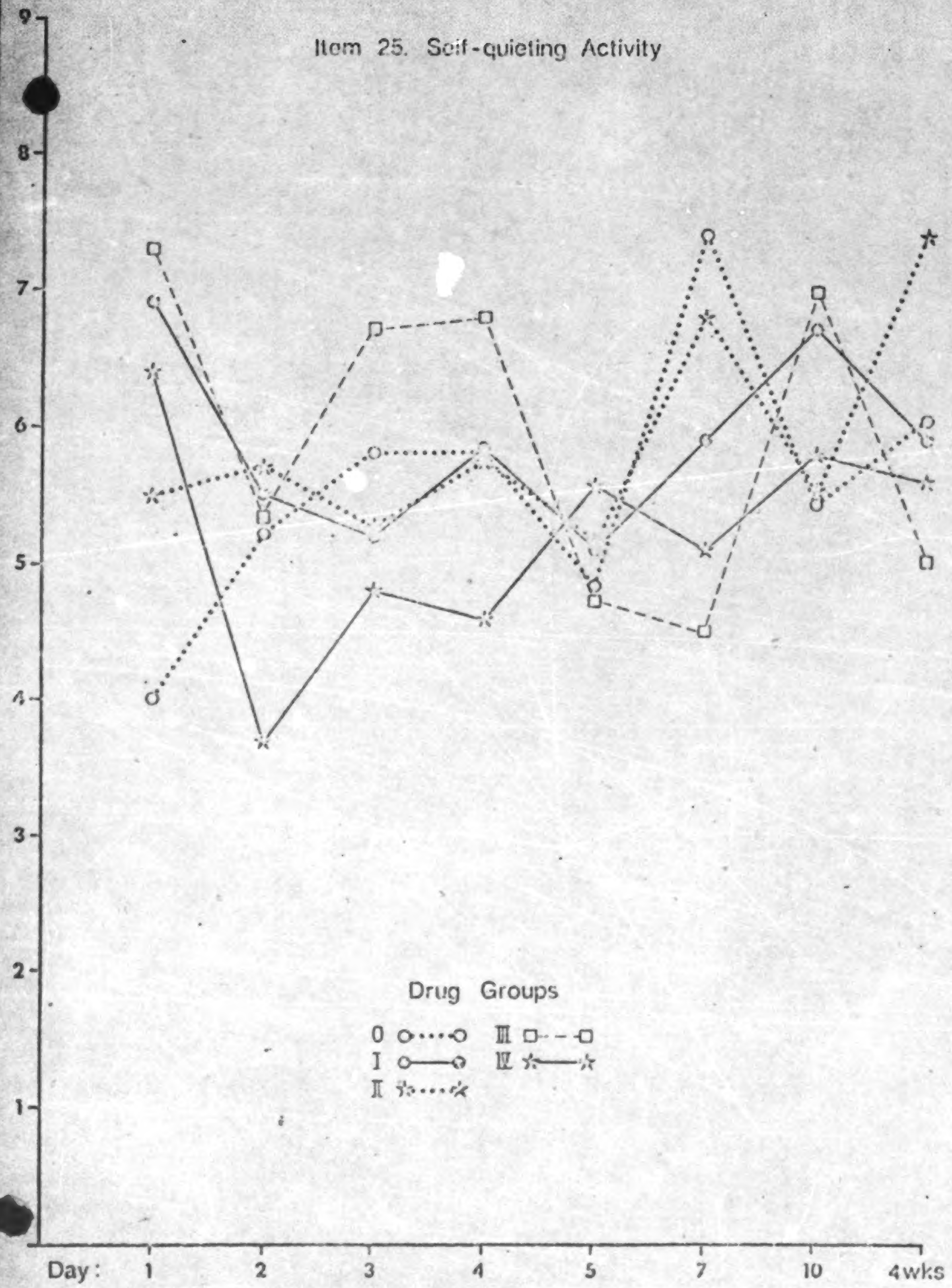

Item 20: Activity
9
8
7
6
5
4
3
2
1
Day:
1
2
3
4
5
7
10
4wks
Drug Groups
0 ○····○
I ○——○
II ☆····☆
III □ - -□
IV ☆——☆

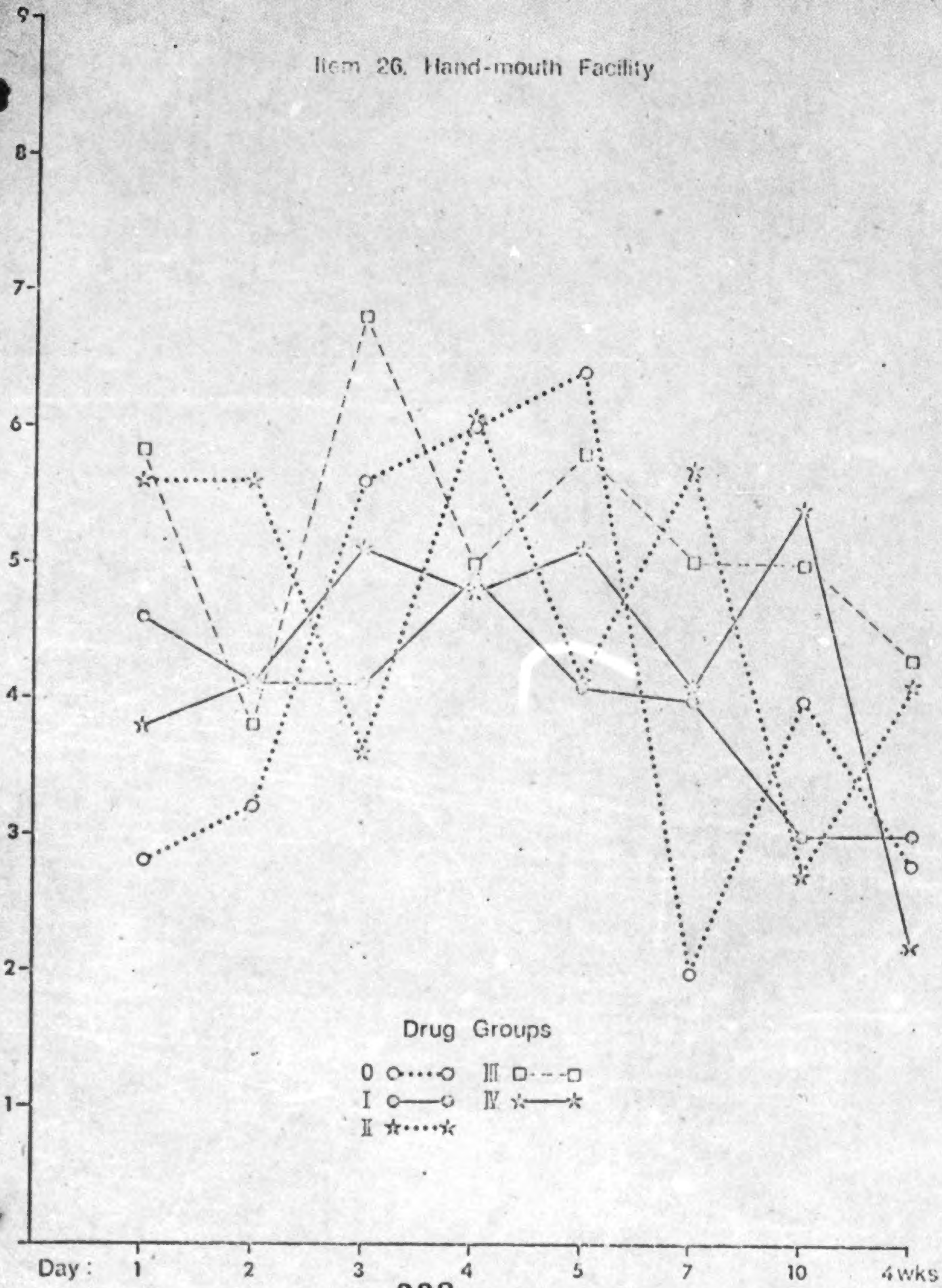

Item 21. Tremulousness


Item 22. Startle

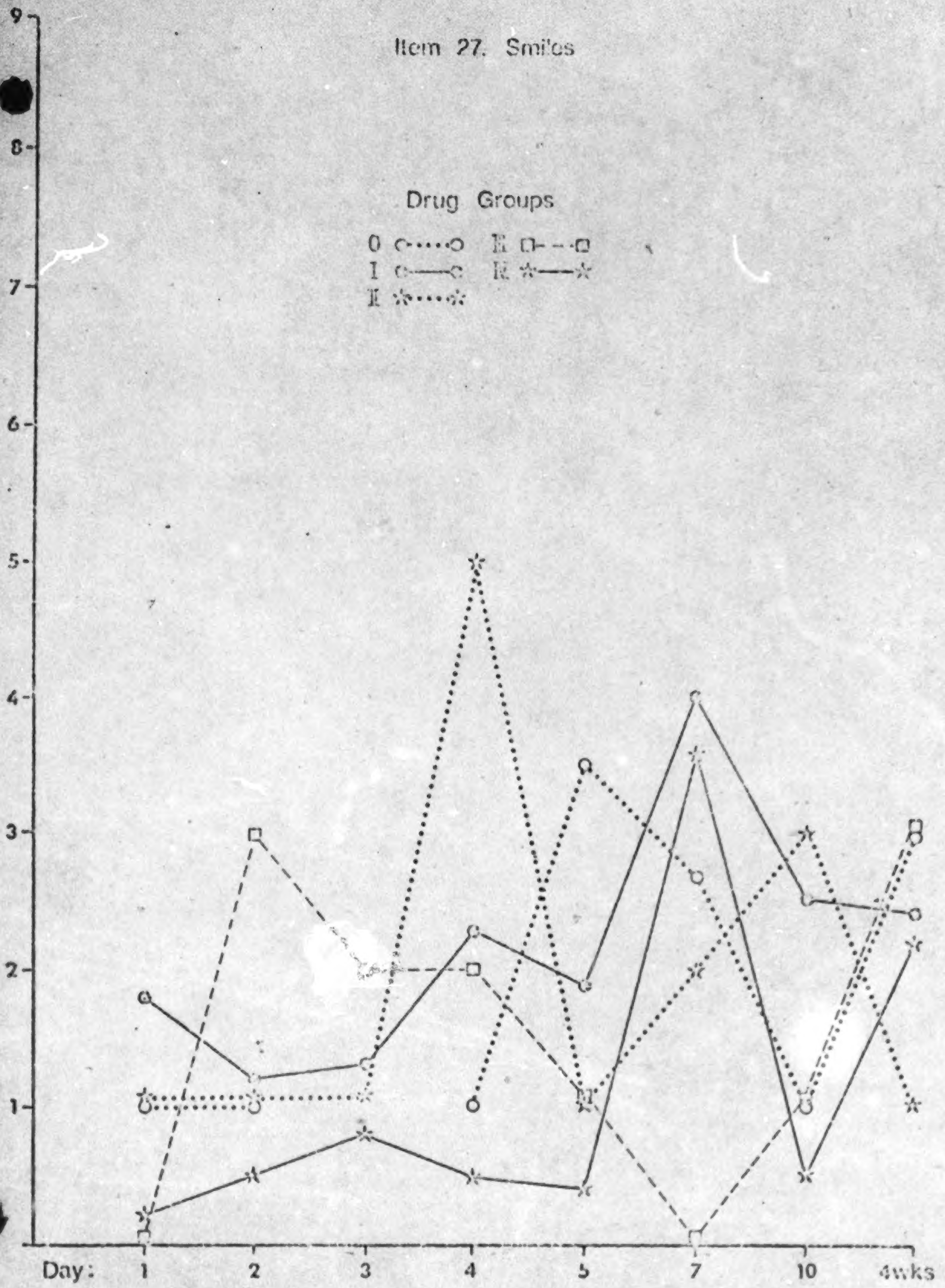

Item 23. Lability of Skin Color


Item 24. Lability of State
9
8
7
6
5
4
3
2
1
Day: 1 2 3 4 5 7 10 4wks
Drug Groups
0 ○····○
I ○——○
II ☆····☆
III □- -□
IV ☆——☆


Item 25. Self-quieting Activity



Item 26. Hand-mouth Facility



Item 27. Smiles

APPENDIX I

APPENDIX I

Profile Analysis for Drug Dosage Groups O, I, II, III, and IV Mean Scores for Marker Item 9 Over Four Testing Days

DRUG DOSAGE GROUP	SEX	DAYS				
		One	Four	Seven	Twenty Eight	TOTAL
O	F (N=4)	5.000	6.750	7.000	7.750	6.625
	M (N=1)	7.000	4.000	7.000	9.000	6.750
	Σ (N=5)	5.400	6.200	7.000	8.000	6.650
I	F (N=13)	5.538	5.231	6.077	7.385	6.058
	M (N=6)	4.833	5.500	5.333	8.000	5.916
	Σ (N=19)	5.315	5.316	5.842	7.579	6.013
II	F (N=3)	7.333	6.000	7.667	7.333	7.083
	M (N=4)	4.250	6.000	5.000	7.000	5.562
	Σ (N=7)	5.571	6.000	6.143	7.143	6.214
III	M (N=4)	7.500	5.500	6.750	8.000	6.938
IV	F (N=6)	3.833	5.000	6.167	6.333	5.333
	M (N=3)	4.333	3.667	5.333	7.000	5.083
	Σ (N=9)	4.000	4.556	5.889	6.555	5.250
Σ	F (N=26)	5.269	5.500	6.423	7.192	6.096
	M (N=18)	5.333	5.222	5.666	7.667	5.972
	(N=44)	5.295	5.386	6.113	7.386	6.045